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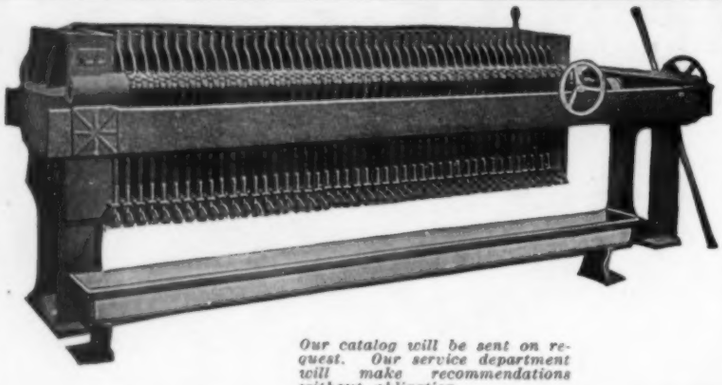

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Editor

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Columbia University Abolishes Six-Year Engineering Courses

FRIENDS of Columbia University will regret to learn of the action of the faculty in abolishing the 6-year course for engineering, including chemical engineering. Coming as it does from one of the leading educational institutions and at a time when educators are concluding as a result of their experience that 4 years is not sufficient time for an adequate course in chemical engineering, the reversal of form by Columbia will have a discouraging influence. When engineering was put in the graduate school several years ago it was hailed as a forward step in engineering education. It was felt that even though there might be a reduction in the number of students completing the graduate courses, the quality would be so improved as to compensate for loss in numbers. Apparently, however, the departments of mining, civil and mechanical engineering have not been impressed with the results of the experiment and have brought sufficient pressure to bear to reduce all engineering courses to the undergraduate school, leading to the bachelor's degree in 4 years and to the engineer's degree in 5 years for such as care to pursue the course.

The action of Columbia in this matter is to be regretted not only from an educational point of view but also with respect to industry and young graduates in chemical engineering. Columbia's own experience since adopting the 6-year course for chemical engineering has been that graduates were in strong demand at salaries ranging from 50 to 100 per cent above those offered to men with only 4 years of college education. Six-year men were obviously better trained and worth proportionately more to industry. It is to be hoped that Columbia has not spoken the last word on this subject and that progressive forces will again prevail, at least as far as chemical engineering is concerned. If mining engineering is in the doldrums and if the other branches of engineering do not feel the need of 6-year courses, chemical engineering is nevertheless in a different class. Its graduates require more extensive education and experience in research in order to achieve conspicuous success in industry.

The Responsibility Of the College

ABOUT one thousand young men will graduate in chemical engineering from our American colleges next month. Perhaps 10 per cent of the number will receive post-graduate degrees. In addition to these a vastly larger number of men trained in the science of chemistry will complete their technical courses. If the engineering group as a whole runs true to form, the majority will immediately enter industrial employment, and the chemical engineering industries will be enriched by this influx of new technical blood.

This product of our technical schools calls attention not only to the important contribution they are making to industrial progress but also to their great responsibility in this direction. Improved processes, cheaper production, elimination of waste, substitution of science for rule of thumb, and all the other concomitants of industrial progress have long since become the function and the sure result of applied science and engineering. And since technical training is prerequisite to these accomplishments, the opportunity as well as the responsibility of the technical school is obvious. Good operators and production men will continue to come up from the ranks of industry, but the great fruits of research and development must come from technically trained men. Henceforth, industrial progress will be made by the technologist and not by the so-called practical man, however well the latter may know the details of his job.

The degree in which the colleges meet this obligation will depend not so much on curricula and laboratories as on the personnel of their faculties. Success will be measured not so much by the label that is put on a course of study as by the philosophy underlying its conception and method of presentation. For chemical engineering is not yet so firmly rooted in all our colleges that it is clearly distinguished from a nondescript collection of courses in industrial chemistry and mechanical engineering. And it is in precisely the degree in which this distinction is perceived and executed that the college will gain recognition for itself and its students in chemical engineering.

Thus the responsibility of the college for its share in industrial progress lies first in a clean-cut recognition of chemical engineering as a distinct branch of engineering, based on a group of unit operations such as distillation, filtration, refrigeration, thickening, absorption, etc., that find application in industries producing such unrelated materials as dyes, sugar, gasoline and cement. Given a course of instruction based on a mathematical and scientific treatment of these unit operations, supplemented by the fundamentals of chemistry, physics, mathematics and mechanics, with laboratory practice and opportunity for observation in the field, the technical school is in a position to produce an embryo engineer useful in any one of a score of chemical engineering industries.

After these essentials are provided, so that the graduate is potentially useful over a wide industrial range, the college can make a still further contribution to industrial progress by emphasizing special courses according to local conditions and facilities. These will be determined in some cases by the specialized ability of members of the faculty; in others by the nature of the industry in the immediate vicinity that can absorb technical men; and in still others by arbitrary decision to cater to a particular market for technical talent. Whatever the circumstances, the present opportunity for the technical school to serve industry is so great as to place upon it a heavy burden of responsibility for rapid industrial progress.

Taking a Sporting View

IN the great Soldier Bonus handicap, which outrivaled the Kentucky Derby as a sporting event, Politics, with Congress up, won by many lengths over Sound Judgment, ridden by the President. The pair faced the barrier with the President a country-wide favorite, he having won a preliminary heat. It was observed, however, that he was greatly handicapped by a heavy weight of economic opinion and preponderance of evidence, Congress being exceptionally light in this respect. It was rumored, also, that some of the President's camp followers had doped his mount and placed their bets on the other horse. The result was almost a foregone conclusion.

Press comment throughout the country reflects a general disapproval of the decision. Even the winners in the betting ring who have been doing some sober figuring to see how much their outing will cost have come to the conclusion that by the time the whole bill is paid the net result will be a personal as well as national deficit. As a sporting proposition the race was exciting, but financially it was a net loss. It is hinted that Congress, flushed with victory, will ride the same mount in the great Tax Reduction Derby. Trial heats in the Muscle Shoals event, however, have shown no promise of victory.

Prospecting For Potash

NINETEEN years ago Edward Atkinson, economist and statistician, wrote as follows in the *Manufacturers' Record*:

> Where there are potash springs there must be sources of potash through which the water passes, taking up its potash on its way to the surface. It follows that there must be many deposits in this country of what may be called mineral potash. These must be sought by boring, and the man who finds a potash mine corresponding to the Stassfurt will add more to the resources of this country than by the discovery of any more gold, silver, copper or iron mines. Who will start the prospectors to bore for potash?

This question may be answered and perhaps Mr. Atkinson's prophecy may also be realized as a result of interest recently focused on the potash beds of western Texas. Prof. J. A. Udden's historic announcement in 1912 of the discovery of potash salts in cuttings and water from borings for oil established the probable existence of extensive deposits in Texas resembling those of the famous German region. There was no commercial exploitation of these resources during the war, but recent investigations of the United States Geological Survey supported by the additional findings of the oil drillers have confirmed Dr. Udden's most optimistic predictions. In three wells recently drilled in Reagan County, Texas, potash beds were penetrated at depths between 1,181 and 1,687 ft. Within workable depths of about 1,400 ft. the cuttings yielded as much as 9.27 per cent K_2O, equivalent to 11.45 per cent of the soluble salts. This compares quite favorably with the average of the German mines.

In the opinion of leading geologists Texas potash constitutes America's most important single natural resource still awaiting commercial development. With the increasing use of fertilizer, as well as the broadening industrial demand for potash salts, the day is not far distant when this country will be requiring each year a million tons of actual potash, or four times its present annual consumption. It is the opinion of Dr. Charles W. Dabney, former Assistant Secretary of Agriculture, that this demand will come within the next two decades.

Obviously the first step in preparing for this demand is the accurate evaluation of our resources of mineral potash. There are a number of reasons why this has not already been done by private interests. The region is too large and land ownership is too divided. The district extends perhaps 650 miles north and south from central Kansas through Oklahoma, New Mexico and Texas and it varies between 150 and 250 miles from east to west. Furthermore, the exploration by the oil drillers has been necessarily spotty and the cuttings from the churn drills give only the roughest indication of the actual geological formation. What is needed if the beds are to be located definitely is a comprehensive survey by core drilling. It is only in this way that the real thickness and richness of the deposits can be accurately determined.

Provision is made for just such intensive exploration in a bill recently introduced in Congress by Senator Sheppard of Texas. The Senate Committee on Agriculture is momentarily expected to report favorably on this measure, which provides for a 5-year program of extensive prospecting for potash to be carried on by the U. S. Geological Survey. The original bill called for an appropriation of $500,000 per year, but our Washington correspondence indicates that this sum is likely to be pared somewhat before final authorization. It is to be hoped that a measure of such deep national significance will not be stultified by the false economy of a penny-wise and pound-foolish Congress. There is reason to believe that the measure may mark the beginning of a real independence for agriculture and the potash-consuming industries. It is worthy of our enthusiastic support.

Bug-Killing Bugaboos

RELENTLESS war on the boll weevil continues to be waged—in the news columns, if not in the cotton fields. A prominent metropolitan newspaper recently urged the government to establish a handsome prize to be awarded for the solution of the boll weevil problem. Not long ago another news item appeared suggesting that perhaps the great German research chemists could be induced to try their hand at the game. From it we learn that "Chemists responsible for salvarsan, for Bayer 205 and for a long list of other remarkable chemical achievements are certainly capable of developing some poison more effective than calcium arsenate in the control of the boll weevil."

To our own unimaginative mind this is worthless drivel that only adds to the delay in arriving at the real solution of the problem. It contributes an air of mystery and uncertainty to the insecticide industry. It encourages the farmer in his *laissez faire* attitude of sitting back and waiting for a miracle to happen. Boll weevil control is a tremendous economic as well as technical problem. It will not be solved over night by a government prize or the brain storm of a German chemist. Rather, the solution will come gradually through the dual process of educating the cotton planter and stabilizing the industry that produces and distributes the necessary insecticide.

Correcting Daugherty's Misleading Publicity

ON March 3 *Chem. & Met.* published an item issued by the Department of Justice relative to a settlement of the account between the United States and the Nashville Industrial Corporation for the purchase of the Old Hickory powder plant. Vigorous exception was taken to the item by B. P. Morse, general manager of the Nashville Industrial Corporation, on the ground that it was incorrect and unjust in its reflection on himself and associates. Mr. Morse's letter is printed elsewhere in this issue.

The settlement in question was made under Mr. Daugherty's régime and the news was issued to the press by the Department of Justice. It was published verbatim in *Chem. & Met.* on the assumption that it was authentic and reliable, no steps being taken to verify the alleged facts. Subsequent correspondence with the Department of Justice has brought a courteous reply from Attorney-General Stone giving the facts of the case, which correspond in all essentials with those stated by Mr. Morse. In this light we conclude that the original item was not only incorrect and misleading but colored to reflect favorably on the achievements of Mr. Daugherty in his post-war prosecutions. Further, B. P. Morse properly objects to being confused with E. C. Morse, against whom an indictment charging criminal conspiracy is still pending. E. C. Morse was director of sales in the War Department but has nothing to do with the Nashville Industrial Corporation. As Attorney-General Stone states, "It is true . . . that certain persons connected with the Industrial Corporation are absolved from any acts of fraud in the procurement of the contract, among whom is your correspondent, Mr. B. P. Morse, who is not to be confused with E. C. Morse, who is not a member of the corporation."

In view of the possible injury that may be done by the misleading character of the Daugherty publicity, *Chem. & Met.* is glad to publish this correction and B. P. Morse's letter.

The Wrong Basis for Gas Quality Standards

THE Detroit City Gas Co. has been authorized to reduce the heating value of the gas supplied by it from 600 B.t.u. per cubic foot to 530 B.t.u. per cubic foot average heating value. It has been estimated that this reduction will permit manufacturing economies of about 5 cents per thousand cubic feet of gas sold. Apparently the authorization of change in standard has been based upon this claimed advantage.

A little figuring will clearly show the undesirability of changes of this sort from the standpoint of the industrial user of gas. Such users of gas in the Detroit district are numerous, and it would seem that their interests should have been considered in this connection before any such change was authorized by the city.

The gas supplied in Detroit costs the consumer 60 to 80 cents per thousand cubic feet, depending upon the quantity used per month. An increase of 5 cents in the price would have meant an increase of about 6 per cent in the gas bill for the average user. To avoid this 6 per cent increase in the gas bill, the company is authorized to lower the heating value nearly 12 per cent. This on the face of it is a penny-wise policy. Industries in other parts of the country should make the point very clear to their local and state authorities.

Industrial users of gas must expect to pay such prices for gas as will permit reasonable profits to the gas company. On no other basis can they expect continued good service. But they can reasonably demand that in return the price be adjusted to give the maximum supply of heat per unit of total cost to the user. The lowest cost per heat unit in the gas works holder should not govern. Gas consumers certainly can and should protest against a 12 per cent reduction in heating value of gas simply to avoid a 6 per cent increase in price.

Solving the Riddle of Hardness

A PARTICULARLY fascinating problem is engaging the attention of a technical committee with which we are in close touch. It is an attempt to derive from the results of various hardness tests a figure that is a direct measure of a given utility of the metal tested. "Hardness" means so many things that it means nothing in particular. Each of the hardness-testing machines on the market measures a different quality of the metal. Each of these qualities is a combination of several fundamental properties, but seldom is it the combination in which the user is most interested. For this reason a hardness test usually gives, not a direct measure of the desired quality, but another figure which, while useful, is only a makeshift.

For instance: The manufacturer of equipment is interested in the machinability of the metal he is working. If cutting conditions are constant, the machinability of the metal can be represented by a number, for it varies in degree only. In order to get the best machinability the buyer usually specifies that the hardness of the metal, according to a given test, shall fall within certain limits. But very often he finds that, although the result of the test is favorable, the machinability is not what it should be. The reason is, of course, that the testing machine does not measure the quality in which the manufacturer is interested.

One type of machine measures a quality that may be called "deformation hardness"; a second measures "penetration hardness"; a third, "flow hardness"; a fourth, "rebound hardness." The consumer is seldom directly interested in any one of these. But he is interested in a property that is probably related to several of them. It is possible that the figures obtained from two or more of these tests, if combined in the right way, will give a figure indicative of the degree in which a piece of metal has the property in which the fabricator is interested.

None of the types of hardness measured by these machines has yet been analyzed with sufficient accuracy to make clear the best method of combining them. But it is recognized that there is an analogy to a set of simultaneous equations, for each test measures the resultant of a different combination of fundamental properties, while the desideratum is the measure of the resultant of still another combination.

Several methods of evolving an expression have been suggested. The most promising at present is the construction of an empirical equation and the application of the "cut and try" method, and until more is known of the fundamentals of mechanical strain in a metal this method will be followed.

An Interpreter of Chemical Advance

No Man Has Done More to Further the Better Understanding of the Chemical Engineering Industries Than the Author of "Creative Chemistry"

A WELL-KNOWN visitor to the Eighth International Congress of Applied Chemistry, held in New York in 1912, was much interested in the meetings at which so many distinguished scientists told of marvelous discoveries. "But," he said, "Why do you sit here and tell one another all about it? Why don't you invite bankers, investors, industrial leaders and business executives to listen to your lectures? They are the buyers of the results of scientific work."

The advice was sound, and yet we have done nothing to follow it. What is the result? When we have an idea to get across, when we have a great institution to build, when we have a process to sell or a company to finance, we find an unsympathetic, uncomprehending public with which to deal. It does not "get" chemical engineering. It still thinks of a chemist as a druggist or as a bewhiskered inconsequential dreamer who talks an incomprehensible language.

There is a bright side to the picture. It is the work of Edwin Emery Slosson; and its importance to the profession and to industry cannot be overemphasized. Dr. Slosson once said of himself that he had been exposed to chemistry, but it didn't take. For more than ten years after his graduation from college he was a teacher and research worker in chemistry, being granted his doctor's degree in 1902. Then he deserted the field for journalism and was for many years an editor of the *Independent*. In 1919 he published a book, "Creative Chemistry," the most widely read chemical book in the world. Here for the first time was painted a thrilling picture of scientific achievement that could be understood by the layman—understood and enjoyed. Dr. Slosson then organized Science Service, a kind of syndicate for broadcasting scientific discovery to newspapers, accurately, yet in such a way that the average newspaper reader could understand and enjoy it.

© by Harris & Ewing

Edwin Emery Slosson

The service that began with "Creative Chemistry" and is being continued with Science Service may be likened to the conditioning of ground before planting the seed. Every man, woman or child that reads "Creative Chemistry" has a better conception of what chemistry can do and of what kind of fellow the chemical engineer is. Some of these readers are bankers, some are investors, some are executives or industrial leaders. They are the buyers of chemistry. They are the men who must be reached.

Dr. Slosson has set an example for us. We cannot duplicate it, for men are not made in his mold often; but we can help to extend the work. In our own circle we can tell of the romance, the significance, the progress, the constructive influence of chemistry, the permeation of industry by chemical control and chemical engineering processes. We can tell of the importance of this to mankind and to individuals. If we do this, then perhaps in time there will be a greater appreciation, a readier sympathy, a more practical enthusiasm. And in those days as now we shall honor Slosson, the pioneer.

Chemical Engineering Methods in Soda Pulp Production

A Survey of Methods and Equipment, With Emphasis on Recent Developments in the Oldest Chemical Pulp-Producing Industry

By Harold J. Payne
Of the Editorial Staff of *Chem. & Met.*

THE soda process for cooking wood pulp, although the oldest and generally considered the most highly developed method of producing chemical fiber, continues to undergo important technical improvements. These are being made possible mainly through the application of the basic principles and type equipment of chemical engineering. Advances that already have been made include the satisfactory introduction of continuous filters in place of the tanks that have formerly been used in washing the pulp and the development of continuous causticizing equipment to meet the specific requirements of the industry. It is with the idea of pointing out these more recent developments in relation to that practice, which has come to be regarded as standard, that this is written. It will be evident that the improvements mentioned have come in connection with increase of the soda cycle efficiency. The recovery of the soda, used in the cooking of the wood chips, is essential to the commercial existence of this process. It is not strange, therefore, that the efforts of chemical engineers have been especially bent in this direction.

The procedure followed in turning out this kind of pulp includes chipping the wood, cooking the chips under pressure with caustic liquor, removing the sodium salts from the digested pulp in the form of "black liquor," evaporating this black liquor and subsequently burning it in a rotary calciner, leaching the carbonate from the "ash" formed and causticizing this carbonate liquor with fresh lime. It is evident that with the exception of the chipping and final refining of the pulp, these operations are all included in maintaining the soda cycle. Efficient recovery of the soda used, important as it is, seldom exceeds 90 per cent of the total amount of soda used.

Preparing Wood for Digesters

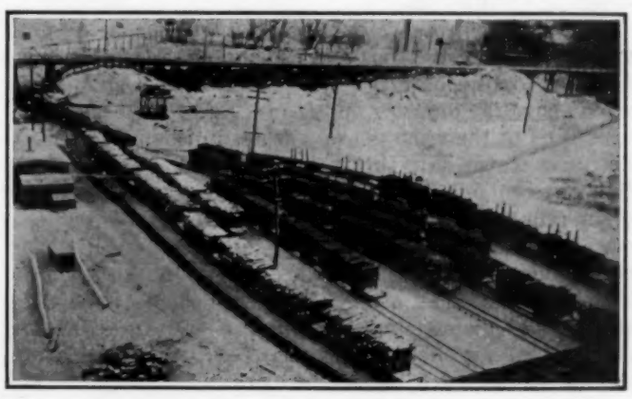
Economical wood chipping is largely a matter of plant layout and equipment upkeep. One plant producing 110 tons of pulp per day has four Carthage chippers (100 hp., 8 ft. in diameter). These are so placed that cars of 4-ft. logs coming from storage piles may be drawn alongside by cable, then when empty returned on an empty car track by gravity for reloading. This system makes for very little lost motion.

Two three-tier shaker screens (8x20 ft., Waterville Iron Works Co.) take care of the sizing of chips in this plant. Oversize chips return to a rechipper, the sawdust goes to boilers and acceptable chips are conveyed by bucket and belt elevator to one of four 30-cord cement digester bins. Each of the digesters at this plant cooks 15 cords (2,500 lb. per cord average). From 1,050 to 1,200 lb., or from 42 to 48 per cent of the weight of the wood cooked, is yielded in air-dry pulp. Laboratory tests indicate, however, that the actual cellulose content of the wood used runs close to 60 per cent of the air-dry weight.

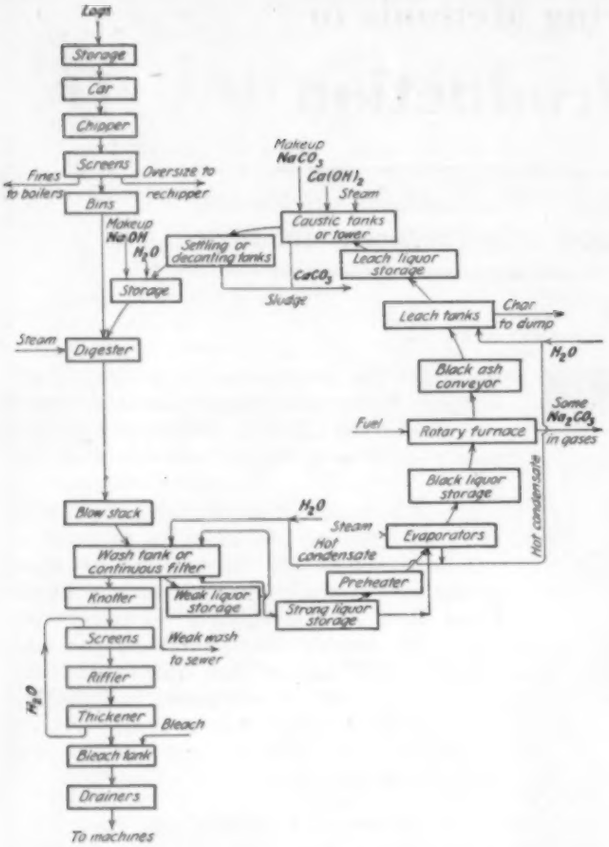
It will be evident that the liquor remaining after the cook carries 12 to 18 per cent of cellulosic substances in addition to about 40 per cent of organic matter such as lignin. When distilled, this liquor gives non-condensible gases high in calorific value, methanol, acetone, aldehydes, phenolic oils, amines, tar, carbon and carbonate. Several mills have experimented with such a process on an industrial scale and it is thought by many that eventually soda pulp producers will recover these byproducts from the liquor.

Factors Governing Cooking Control

The practice of cooking with a liquor carrying 90 per cent caustic and 10 per cent carbonate from 11 to 15 deg. Bé. is common. This varies from plant to plant, according to individual ideas and also according to the amount of moisture in the wood. Wet poplar from the river, for instance, carries the equivalent of 200 gal. more of liquor per cord than wood that has been seasoned in air. About 525 lb. of soda is required per cord of wood cooked, although this must be increased if larger quantities of hard wood are put through, or decreased if the wood is somewhat rotten. The length of the cooking cycle varies from 6 to 8 hours (including filling, raising to pressure, digesting at pressure, blowing and closing valves), the pressure averages about 120 lb. per sq.in., and the temperature averages 350 deg. F. One mill adds 50 gal. of 12 deg. Bé. black liquor per cord at the start of each cook, having found this to save soda and to improve the pulp. Former objections to this



Carloads of Logs Ready for Chipping
Poplar, birch and maple already barked are conveyed from storage piles to mill by this means. Cars are drawn up to chipper by a cable drag, then returned by gravity for reloading.



Relation of Pulp Production to Soda Recovery

The vertical line of flow at left indicates the essential steps directly involved in processing the pulp, while the circle shows how much chemical engineering is used in maintaining the soda cycle.

practice because of the alleged effect upon bleaching properties are not found to be serious at this plant.

During the cooking period, circulation of the liquor over the pulp is essential. This may be brought about through a relief valve out of which inert gases may pass. The upward movement of such gases causes fair agitation. By another method circulation is maintained positively by means of a centrifugal pump drawing liquor from below the false bottom in the digester and injecting it in a spray over the upper surface of the chips. The use of steam injectors located at the base of vertical pipes running up and down close to the digester walls has also been found a satisfactory method of insuring circulation.

Heat economy has been greatly increased at several mills by lagging the tops and walls of the digesters with a heavy coating of magnesia. A removable steel plate rests above the digester and is practically flush with the floor level of the room above. Instead of being intensely hot on a warm day, this room is cool—no need to say that the coal bill is proportionately less! At one mill other refinements have been installed for increasing the efficiency of operation. Included in the list are digester room gages showing the exact levels in the cooking liquor storage tanks, a very simple and compact chemical testing closet and sumps underneath the digesters for conducting any liquor escaping from the circulation system to the black liquor storage tank.

When the cook is complete, it is "blown" through a "stack" to tanks for washing or storage. The function of this stack ("blowpit and cyclone") is to allow release of steam and the vapor without loss of fiber or liquor. This is successfully accomplished by imparting to the pulp a whirling downward motion by means of baffle plates. From the bottom of the stack it is possible to drop the pulp into one of a number of tanks arranged in series.

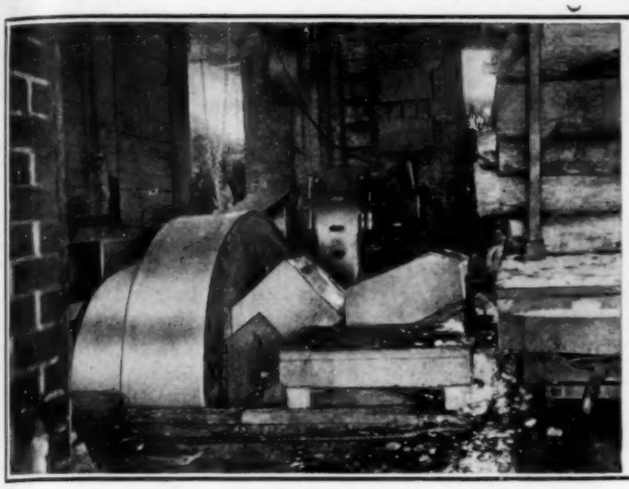
By the common method of washing, the removal of the black liquor is a simple step process beginning with applications of weak liquor and ending with washing with water. The operation is not complex, although constant care is required in regulation. Weak liquor is used on the freshly blown pulp until the strength of the wash approximates that of the original liquor flowing on to the top of the tank. Up to this point the wash is run to evaporator storage. Hot water is then turned on and is run to the weak liquor storage tanks. When the solid content has dropped so far as to make further soda recovery impracticable, the washes are passed to the sewer.

It is essential at this point to get out the soda, until the wash water shows a zero Beaumé reading. The cost of evaporation demands, however, that the composite washings shall not have too low a gravity—and naturally the higher this gravity may be the better, providing no soda is lost. Efficiency in this washing is difficult to obtain. For this reason the use of a vacuum filter, such as the Oliver, has much to commend it.

Where tanks are used they are ordinarily arranged to allow at least 12 hours for the washing cycle. These may either be lined up in groups or arranged in continuous series. The former arrangement makes possible a simple and efficient method of circulation of the liquor from tank to tank, and eventually to evaporator storage. When groups of five tanks are used, the drains may be piped in such a manner that at one central control point, just as in the gallery of a sugar mill, the circulation may be directed by shifting outlets from one compartment to another in a three-way sump. One compartment leads to evaporator storage, the second to weak liquor storage and the third to the sewer. Beaumé readings of the washings are made here and their volume and per cent solids are controlled by manipulation of water and weak liquor proportions used in the washing. Actually about 1 per cent of the total soda has been found to go out with the final washes. The strength of the liquor to the evaporators shows about 75 per cent of that at which it was blown from the digesters.

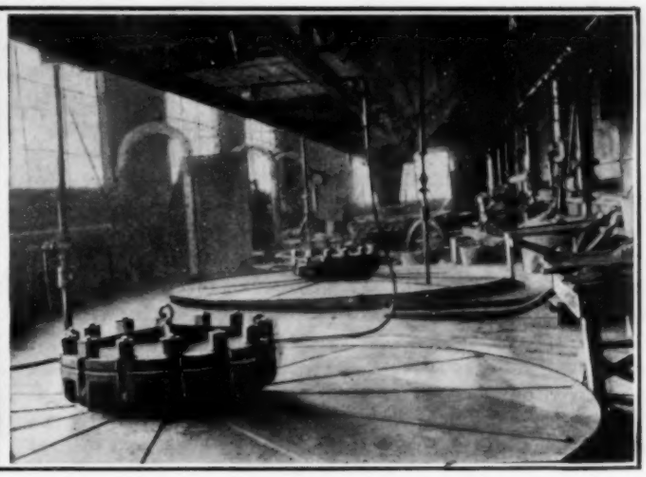
Application of the Continuous Filter to This Operation

The problem of washing successfully with vacuum has been solved at the plant of the Champion International Co., Lawrence, Mass. Other mills are experimenting with the use of such filters, although at the present time their operation has not been fully perfected. In using such a filter the pulp is sent directly from the blowpit to storage and thence to the feed of the rotary filter. The filter itself is covered with Monel metal screen, but is otherwise standard in construction, except for the arrangement of the spray nozzles used for the wash water. The thickness of the pulp flowing onto the screen is regulated to a cake about 1½ in. thick by means of a wire doctor running across the face horizontally just above the point where the liquor has been first drawn through. Sprays of hot water (usually condensate from the evaporators) are directed against the slowly revolving cylinder and are drawn through very rapidly. The essential difficulty appears to be the complete removal of the soda in the layer next the screen



Carthage Chipper With Log Car Alongside

Such a machine mechanically disintegrates 50 cords of pulpwood per day. The logs are first sliced by a rapidly revolving disk knife in the casing; the slices are crushed in such a way that the chips are about ¾ in. square by ⅛ in. thick.



View of Floor Above Digesters

Chips are being run into the digester in the background from the bins above. The tops of the digesters in the foreground show how the seal is made when pressure is applied. Liquor is fed in from pipe on right, steam from mains on left.

face of the filter without the use of a larger amount of water than is advantageous from the viewpoint of the evaporator department.

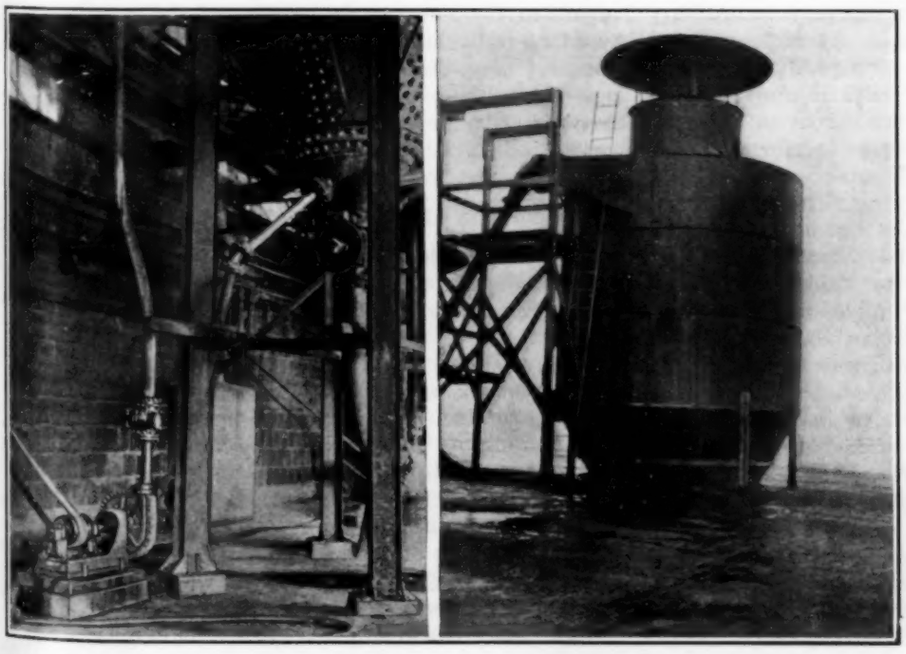
On account of the black liquor density obtainable by the old tank washing method (9 to 10 deg. Bé. depending on concentration of original cooking liquor), it appears necessary for the filter to give as high a density as 11 deg. Bé., or 1 deg. Bé. drop from the original entering liquor, to commend itself fully. The two principal advantages obtainable by the new method are decreased time and space. On the other hand, more power and more complicated equipment are involved. It is estimated that one man may take care of one filter handling 500 lb. of air-dry pulp per sq.ft. per 24 hours.

Refining of the pulp and the recovery of the liquor begin where the washing ends. It is found advisable to run the liquor from tank washings through screens to remove shives and chips—else as much as 50 lb. of fiber per ton may be lost. From here the liquor may run either directly to the evaporators or through a preheater—one mill uses a regular waste heat boiler upside down for this heating. In some mills the liquor input to the evaporating system is measured by a venturi meter and gravity recorder. In this way a reasonably accurate check on efficiency may be obtained at all times.

How the Black Liquor Is Evaporated

The evaporator equipment in favor for taking down the dilute black liquor varies widely from mill to mill. Simplicity of construction, ease of cleaning, readiness of exact level control and rapid, even circulation are the factors to be considered here.

Three sets of equipment that might be considered as typical are as follows: For a 100-ton mill, one four-effect Swenson, two three-effect and one four-effect Yaryans. In this plant the Yaryans are found to live up to rated capacity, but the repair bills are considerable, due mainly to gasket leaks. The days of service obtainable, therefore, are not so high as is desirable. The Swensons, on the other hand, are easier to clean and to keep in repair, but are found to fall 20 to 30 per cent short of their rated capacity.



Bottom of Digester Showing Blow Valve

The small pump in foreground maintains circulation of the hot liquor during the cooking period, drawing it from below the false bottom of the digester and forcing it in a spray into the top. Opening the valve allows the pulp to be forced into the stack shown in the accompanying picture.

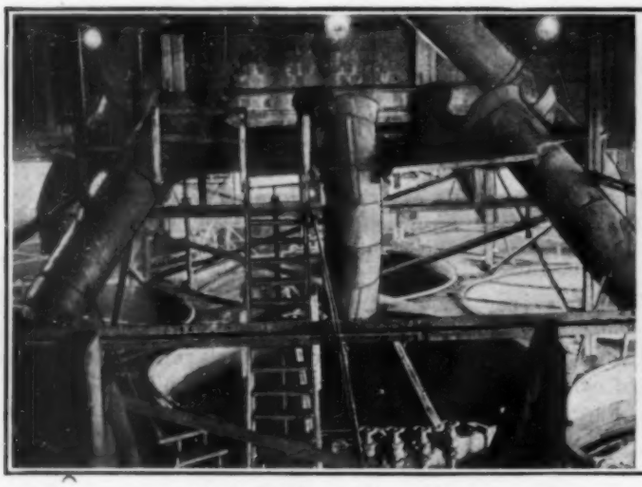
Blow Stack Separating Pulp From Steam

The pulp is forced by digester pressure into this "cyclone blow pit." A whirling downward motion is imparted to the contents of the digester by baffle plates. Steam escapes to the atmosphere without appreciable loss of liquor or of pulp.

A second mill producing 110 tons per day uses two five-effect vertical tube evaporators of special design and one two-effect Buflovak concentrator. In the quintuples the concentration is carried from 9 to 11 deg. Bé. to 30 to 34 deg. Bé., while the Buflovak turns out the liquor to the rotary calciners at 100 deg. C. and 38 deg. Bé.

A third plant producing 166 tons per day uses two four-effect Newhalls that turn out liquor at 30 to 34 deg. Bé. and 108 deg. C.

Comparative figures on steam consumption are not available. Likewise the best manner of circulation is not agreed upon. The point of difference is as to whether straight parallel flow of steam and liquor through successive effects gives as satisfactory operation as staggered flow. It is believed by some operators that it is best to run liquor into a middle effect, pass to the third (possibly to the fourth), thence back to the first effect. In ths way the evaporated liquor is delivered as hot as possible to the calciners.



A Battery of Washing Tanks

Pulp dropping from the base of the blow stack may be sent to the various tanks by the piping arrangement shown in the upper center. A counter-current step system of circulation is used in washing the pulp free of sodium salts.

Closeup of a Washing Tank

Two spray pipes are shown over the tank in the foreground. Strong black liquor, weak black liquor, hot and cold fresh water are applied in washing. The operation is conducted to give strongest possible wash liquor.

In all cases the liquor has to be pumped from the final effect of the evaporator to the incinerator storage tank. The incinerators are similar in appearance to ordinary rotary kilns—a burner usually about 14 ft. long and 8 ft. in diameter is placed in line with a revolving furnace having the same end opening, but with an over-all diameter of about 12 ft. and a length of from 18 to 24 ft. Five such calciners handle the liquor comfortably in a 110-ton mill. One of the most troublesome difficulties in their operation seems to be ring formation at the point in the incinerator where the liquor goes over to the solid phase. This may be partly overcome by intermittent addition of the liquor or by placing a steel rail mounted on small wheels at right angles to its length in the bottom of the revolving cylinder. About 2,700 to 3,300 lb. of coal is burned in each unit per 24 hours, although it has been found possible to burn shavings with somewhat lowered capacity. An average figure of 28 lb. of ash produced per pound of coal burned appears to be fair. Waste heat boilers, around the flues of which the hot gases (from 425 to 1,200 deg. F.) pass up the stack, produce about 75 to 85 hp. at 125 lb. pressure. In some mills the practice preferred is to use these waste heat boilers to heat water for washing or leaching purposes. In certain cases boilers are built somewhat out of line with the burner and calciner, but better results are claimed when the gases pass straight up from the end of the calciner.

At best the gases passing out of these furnaces contain small quantities (3 to 5 per cent on basis of total kiln output) of sodium carbonate, but it appears doubtful whether treatment to recover this will be feasible for a long time. The use of the Cottrell precipitator has been suggested here. The consensus seems to be that there are larger losses more open to cutting than those at this point. It is evident that the larger the cross-section of the rotating burner in relation to its length the lower will be the velocity of the gases passing through. Decrease in this velocity obviously results in decreased losses of dust carrying soda.

The black ash from the calciners is carried either by bucket conveyor or by cars to the leaching room, where separation is made of soluble sodium salts from the char. The best practice here is to elevate the leaching tanks as far as possible, in order to make gravity flow a possibility in the caustic producing plant.

One of the largest sources of loss of soda undoubtedly occurs in the leaching department of the mill. Unfortunately, reliable quantitative data cannot be readily obtained here—but by the method of elimination it is possible to show that other accountable losses leave a large fraction for this department to account for.

The soda in the black ash constitutes 70 to 75 per cent of its weight. The leached residue carries at least 3 or 4 per cent of soda or $\frac{25}{100} \times 4 = 1$ per cent of the weight of the original ash entering.

A series of cement or iron tanks is used in most plants for conducting the leaching operation. The hot ash is dumped, leach liquor from a tank that is nearly free of soda is pumped into the bottom of a given unit and percolates up through its contents. Four or five washes are given each batch, the fresh hot water entering the tank most nearly ready to dump.

At present the system as outlined appears to represent very nearly standard practice. The use of continuous filters has been suggested for more rapid and efficient washing of the ash, but as far as is known, no such installation has been made as yet.

The carbonaceous residue is not generally useful and is ordinarily discarded. A 110-ton mill must dispose

of about 35,000 lb. of this per day. It has been suggested that the leached black ash might be used as a pigment. Small amounts can be used as decolorizing chars. Actually, it is suitable for these purposes, but obviously the demand does not begin to approach the supply. Here is very nearly a dead waste—a use for this material would give the soda industry a new prop on which to stand. Although it might be used as a fuel (14,000 to 15,000 B.t.u. per lb. dry), this use has never been developed commercially. A typical analysis for this black ash residue is: Moisture, 6.06 per cent; Na_2CO_3, 2.5 per cent; $CaCO_3$, 1.17 per cent; Na_2S, 0.37 per cent; MgO, 0.34 per cent; $Fe_2O_3 + Al_2O_3$, 0.26 per cent; SiO_2, 0.17 per cent; $CaSO_4$, 0.07 per cent; C, 89.05 per cent.

The leached liquor from the black ash system runs from 20 to 26 deg. Bé. It flows, preferably by gravity, to the causticizing department. It would seem quite possible that great developments may take place in this phase of the operation of a soda mill within the next few years. It has been said that the tank system for renewing the caustic liquor [$Ca(OH)_2 + Na_2CO_3 = CaCO_3 + 2NaOH$] is becoming obsolete. Nevertheless the old method is far more common than the continuous system such as that now being installed by the Glamorgan Pipe & Foundry Co. In the older plants procedure varies, mainly in accordance with individual ideas.

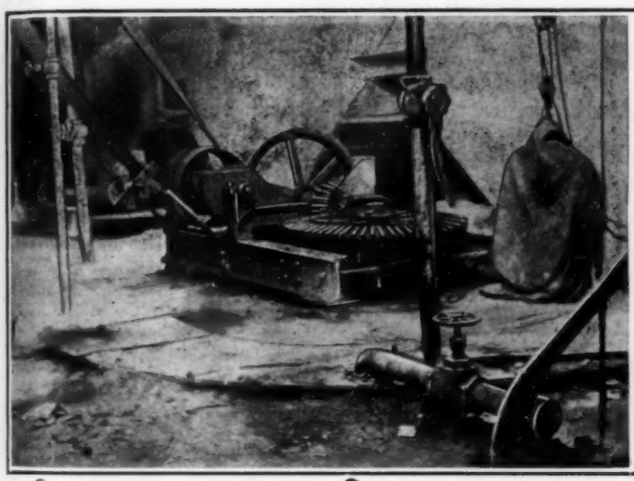
One plant (165 tons capacity) carries on its main causticizing reaction in one tank. Batches are boiled with lime (60 lb. lime, 100 lb. Na_2CO_3), using steam for heating, for 20 to 30 minutes, when the reaction is 80 to 90 per cent complete. Each batch then drops to one of the series of six batteries of five tanks each. These tanks hold 5,000 to 7,000 gal. Here the operation is finished by four reboilings and settlings, thus building up the strength of the caustic by appropriate sequence. Each battery is operated as a unit—in every tank paddle stirrers having small clearance over the bottom of the tank are used for agitation. The amount of soda lost here is very low unless the demands on the department are such that insufficient time is available for completing the reaction or for making adequate washings.

The product of the caustic department is made uniform and of a strength suitable for digestion by additions either of caustic soda or of water. When caustic soda is not available, soda ash is used for make-up, being brought into the system with the leached black ash.

A variation in this system is in practice even more general—that is the elimination of the primary causticizing tank. The lime and leached liquor are boiled, the caustic drained off with a siphon, and counter-current step washing and boiling is employed for finishing the batch. This is probably the most common system in operation in this country today.

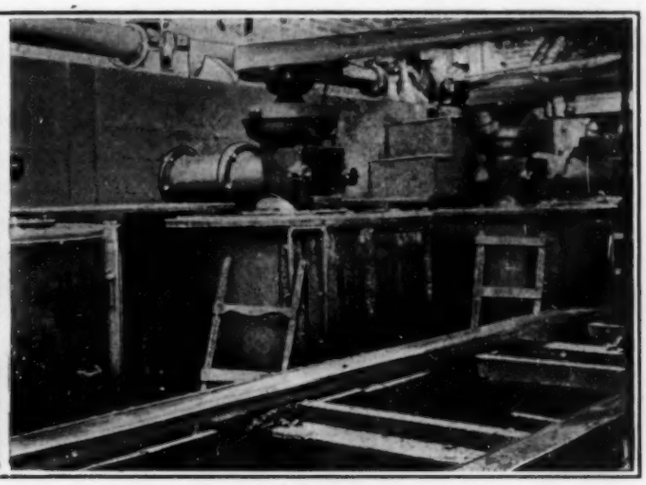
Disadvantages of the Tank System

Frequently 4 to 8 per cent of the soda is lost due to incomplete washing. The production of uniform liquor requires constant alertness on the part of the operators. With so many tanks in the system, each usually holding from 5,000 to 7,000 gal., overflow losses are considerable. Heat efficiency is relatively low, due to the repeated boilings required and to the fact that none of the heat is conserved. Many tanks, with agitators and motive power for each, introduce a large upkeep charge. Finally, the demands in space are considerable.



Driving Gear on Causticizing Tank

This is the standard apparatus used for making the caustic cooking liquor from slaked lime and soda ash. Three or four reboilings and settlings are necessary to complete reaction and to free sludge from sodium salts



Centrifugal Screens Removing Small Shives

This operation is sometimes conducted in diaphragm screens, but the apparatus shown is fully as efficient and possesses the advantage of space economy. Five such centrifugals readily screen 110 tons of fiber per day.

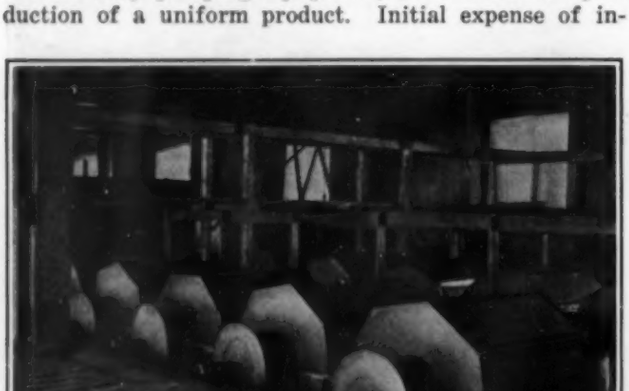
Continuous causticizing is a relatively new project in the pulp industry, although it has been used quite extensively in the commercial production of caustic, as at the plant of the Diamond Alkali Co., Painesville, Ohio. The equipment consists of a reaction and heat recovery tower, a continuous decanter and a continuous filter for washing the lime sludge. In one 100-ton plant where such equipment has been installed, twelve old causticizing tanks have been eliminated.

The equipment used in replacement consists of a ten-section reaction column 6 ft. in diameter by 34 ft. high, of a decanter holding 40,000 gal., and of four continuous filters, each 6 ft. in diameter by 3 ft. wide, that operate in series of two on the sludge. In operation the leached liquor is pumped to the top of the reaction column, which is heavily lagged to prevent heat loss. The freshly prepared lime from one of two slaking tanks enters at the third section from the bottom. The downward course is interrupted by compartments with mushroom-shaped baffles. Steam, that may be exhaust at 10 lb. pressure, and air enter at the bottom to cause agitation and to provide the required heat for reaction. This steam is entirely condensed in its passage up through the tower, with the result that the soda ash solu-

tion retains practically 100 per cent of the heat input. By the time the bottom is reached, the reaction is 80 to 90 per cent complete. The caustic sludge is then pumped to the center downtake of the decanter tank.

The carbonate slowly settles out and is moved toward the outlet at the base of the cone that constitutes the lower section of the decanter tank. The clear liquor rises and is continually taken off in an annular trough at the top. The sludge is pumped to the filters that are operating in series. The cake of carbonate formed, about 1½ in. thick, is washed with hot water on each filter and is then discarded. The washings are returned to the center downtake of the decanter entering with the caustic sludge from the tower.

It is evident that this system has certain merits—notably the decrease in caustic losses in the sludge through inefficient washing, the decrease in space and in necessary pumping equipment, and continuous production of a uniform product. Initial expense of installation is relatively high, although its lessened labor requirement partly offsets this. Likewise it is thought that caustic efficiency is subject to improvement through this means, although one mill that has just begun operation finds its overall caustic efficiency (82 per cent) to be unchanged.



Octagonal Screens Thickening Pulp

After oversize fibers and foreign material have been removed, the pulp must be thickened before being bleached. As the stock passes under these screens, water passes through the webbing and out through a hollow trunnion.

Refining of Soda Fiber and Bleaching

Black liquor parted company with the fiber in the wash pits under the digesters. To return to the path that the pulp takes when freed from the cooking liquor, it is next necessary to consider the refining processes. As washed, the pulp carries chunks of undigested fiber and heavy particles of foreign materials. As in the sulphite process (*Chem. & Met.*, vol. 29, No. 19, Nov. 5, 1923), knotters, screens and rifflers are used here. The usual knotting operation may be carried out in the commercial machines or in a simpler "made in the mill" device. A trough with a perforated bottom is mounted over a tank and fitted with a scraper conveyor. This trough is mounted on a pitch at an angle of approximately 30 deg., the stock enters at the lower end and is dragged over the perforations by an endless conveyor. Knots are carried out into a cart, being washed free from adhering fibers by sprays before leaving the perforated trough.

From the knotters the pulp passes either to diaphragm screens or perhaps to centrifugals. At one plant where such centrifugal screens are used, it is found that 15 hp. is required for operation where the pulp output is 25 to 30 tons per 24 hours. One outstanding advantage in the use of this type of screen (Baker Manufacturing Co.) is in the space economy effected.

Sand settlers or rifflers follow the screens and practically complete the refining except for thickening. This last operation consists in drawing the excess water from the pulp through slowly rotating cylindrical or octagonal screens.

The knots recovered (large ones from the knotters and small ones from the screens) are used either by grinding and making into very low-grade pulp, or they are redigested in small boilers. It is found that only 3 cords, or approximately 1½ tons of pulp, is produced from recovered knots in a total production of nearly 800 tons per week, at a plant where the process is carefully controlled at all points.

Bleaching Soda Pulp

The final operation of bleaching is carried out under ordinary practice in tanks arranged in series of four and so proportioned in size that approximately 2 hours is required for passage through the system. A temperature of 90 deg. F. and a consistency of 96 per cent water are the conditions maintained. The bleach requirement runs about 240 lb. per ton on the basis of 35 per cent powder (available chlorine).

Washing tanks, preferably tile lined with perforated tile bottom plates, are used for storage, finishing the bleaching and for washing. A total time of at least 6 hours is required to complete the bleaching operation.

Where Are Developments to Take Place?

Evidences are numerous that all pulp-producing industries are realizing what benefits are obtainable through the application of chemical engineering principles to their own peculiar problems. In the case of soda pulp, these are numerous, leaching, evaporation, calcining and causticizing being included as major items. The old prejudice toward "new-fangled notions" is gradually disappearing. Advances of great value are bound to grow out of the new attitude.

Iodine as Fertilizer and as Food

Research has recently been carried out which has shown that iodine may play an important rôle in soil fertilization. As with humans, where iodine has been shown to be an essential to health, only minute amounts are advisable to produce good results; in fact, poisoning may be brought about as easily in plants as in humans. Experimentation has shown that the application of about 1 lb. of iodine, as potassium iodide, per acre resulted in an increase of yield amounting to about 1½ tons of sugar beet per crop.

Sea salt for human food and Chilean nitrate for plant food are carefully purified of iodine before being put on the market. It has been suggested that it may be a wise plan to dose the community with a minute amount of iodine added to salt or domestic water used for human consumption, as is being done in Austria. The Iodine Association in Chile is anxious to find new uses for its product, most of which is discarded in an endeavor to maintain prices. Some engineers believe that inclusion of the minute amount of iodine needed to stimulate plant growth could be added to all commercial nitrate from Chile, thereby enhancing the product for fertilizer purposes at a negligible cost to the producers.

Ten Years of Progress in Petroleum Refining

Trend of Technical Development in an Industry That Has Expanded Eight Times in the Period 1913-1924

IN 1913 the refineries in this country were taking from the crude oil distilled about 12.5 per cent of naphtha, representing in volume about 22,000,000 50-gal. barrels. In 1923 this percentage was nearly 31 per cent, and the volume nearly 150,000,000 bbl.

During this decade, from 1913 to 1923, the petroleum industry's most outstanding development was of processes for cracking at pressures above atmospheric. Up to the beginning of this period the crude oil process was still largely built up around illuminating oil as the principal business; the production of naphtha being limited to the natural naphtha content of the crude, and the small percentage secured through cracking or decomposition of the heavier fractions when running the crude to coke in the ordinary fractionating still.

In the early part of this decade the demand for naphtha had overtaken the supply, and the petroleum industry had to change its process and make higher flash test illuminating oils, thus securing the lighter fractions from the refined oil cut to augment the supply of motor fuel.

The industry realized that it could not keep pace with the unusual demand for gasoline by running more and more crude, as there was no adequate outlet for the production of the other products. Dr. W. N. Burton, of the Standard Oil Co. (Ind.), who had been carrying on experimental work in cracking the heavier petroleum distillates on increasingly larger scale operations, succeeded about this time in commercializing what is now known as the pressure still, and a new era was begun.

During the last few years the progress of the refining industry has been built around "cracking." It is estimated that in 1922 about 25 per cent of the total gasoline production of the country was secured through cracking at pressures above atmospheric. In 1923 the production from cracking was probably not so great proportionately due to the overproduction of crude oil, particularly in California. It is estimated that in 1923 there were something like 2,000 pressure cracking units of various designs in operation in this country, with an estimated production capacity of 45,000,000 bbl. of naphtha per year, or about twice the total production of naphtha in 1913. Rough figures, assuming average unit capacities and naphtha yields, would seem to show about 132,000,000 bbl. of naphtha produced from crude in refinery operations, 22,000,000 bbl. recovered from natural and casinghead gases and 40,000,000 bbl. in superatmospheric cracking operations.

Unfortunately there are no accurate statistics available on the amount of heavy oils cracked for the production of naphtha, or on the total yields of naphtha from this source. Not only do the various types of processes vary markedly in respect to the charging capacity and naphtha yields but the same type of process under different conditions is run at widely varying capacities and naphtha yields. It has only been possible to give the roughest estimates, but they are sufficiently accurate to indicate the place which pressure cracking occupies in the industry.

> In the answer to the question of how an increase of 176 per cent in the amount of crude oil run through petroleum refineries provided for an increase of more than 1,100 per cent in the number of automobiles in use lies a most interesting story—the evolution and development of the cracking process. How a yield of 12.5 per cent of naphtha from the crude run in 1913 was brought up to nearly 31 per cent in 10 years is described in this article.

The constant and rapid increase in the consumption of gasoline through the multiplication of automobiles, trucks, tractors, airplanes, motor boats, etc., led to an interesting development of other sources of supply of gasoline:

First, the absorption plant for taking light volatile naphtha from natural gas; following this, development of the so-called casinghead plants, designed to save the light naphtha from crude oil wells, this naphtha being recovered by means of absorption plants, or compression plants, and sometimes a combination of the two. At first this naphtha was so volatile that the evaporation losses made it hazardous and unprofitable to handle. The product is now stabilized by various methods, the "wild" gas going back into a gas system for burning as fuel. The production of this naphtha in 1923 reached a total of about 22,000,000 42-gal. bbl., and can be greatly increased by the application of recovery plants to all available gases, particularly in flush pools.

Another step was to extract naphtha from non-condensible gases in refinery operations, which gas had previously been burned as fuel. This practice is now almost universal.

Other Changes in Refinery Practice

Continuous treating has been developed to replace the old system of blowing the products to be treated in an agitator with air. Today naphtha and other volatile products are treated in a completely closed continuous system, minimizing loss of product and eliminating explosion hazards.

The development of foam for the extinguishing of tank fires has resulted in better control of oil fires, so that the risk today in a properly equipped refinery with fire banks, steam and water lines and a fire foam system for blanketing the surface of the burning oil, shutting off combustion and extinguishing the fire, is very small. The number of fires has been very greatly reduced until now in a well-equipped plant they are the unusual thing.

Some of the higher alcohols are now being prepared commercially.

The production of white mineral oils, or what are sometimes called medicinal oils, has developed into an important business. The manufacture of these oils was rapidly developed following the outbreak of the World War which shut off the supply of Russian white mineral oil.

Intensive commercial research work in the industry was not really started until after the armistice. Such work as was done before was in the nature of finding a

Extracts from an article, "A Decade in the Petroleum Industry," appearing in the April, 1924, issue of *The Lamp*, published by the Standard Oil Co. of New Jersey.

solution for particular problems as they arose and there was no comprehensive effort made to survey and analyze the possibilities of improving methods generally in use and regarded as satisfactory. The refiner did the best he could trying to meet changing market demands with existing facilities, oftentimes with apparatus that had grown out of date. The real beginning of intensive research work on the problems of refining crude oil was not made until 1919. It was greatly stimulated 2 years later when the reaction set in from the boom period, forcing curtailment and close analysis of every detail. The refiner then began to study his methods carefully.

Progress on this line has been slow, because the industry has no written history. Engineering and chemistry of petroleum had never been taught, so there was no technical source from which talent could be drawn. It has been necessary for the industry to take men trained along general chemical and technical lines and teach them its history and problems before asking them to find the solution. Now the interest of many schools and universities has been enlisted and efficiently trained scientific help is becoming available. Special courses in petroleum are being added to the curriculum in colleges.

This wider interest gives promise that the next decade will show a greater advance in the art of refining crude petroleum than has been shown in the entire history of the industry to date.

Progress in Gas Manufacture

High Lights in the Review by Haslam and Thiele for A.C.S. Gas and Fuel Chemists

OXYGEN in gas making and for metallurgical work is one of the striking recommendations of recent months. The only commercial attempt in this field is about to begin at Worcester, Mass.

The use of the back-run water-gas process is a striking chemical engineering achievement of the past year or more. The use of bituminous coal in water-gas generators and the application of accumulators in water-gas plants have both been conspicuous advances of recent months. The accumulator so applied is a large tank of hot water intended to take up excess exhaust steam by condensation and subsequently to give it up by boiling when the deficiency of steam causes a small drop in pressure. This accumulator acts as a balance wheel on the steam line to the water-gas machine and stabilizes steam generation, with consequent economy.

Most important results in blue water-gas plants have come from English reports by the Fuel Research Board and the Institution of Gas Engineers. The slagging type gas producer has also received attention in Europe, particularly in Germany and in France, where the advantages claimed for it are high capacity, use of high ash coal and low labor cost. Its adaptability to the steel industry is suggested.

Liquid purification by the Seaboard process is mentioned as the most conspicuous advance recently in this phase of gas production. The sale of gas on the therm basis in England also suggests similar possibilities in America. The closest analogy yet adopted in this country is in Colorado, where gas companies choose their own gas standard. House heating by gas is an important prospective use.

Efficiency in gaseous combustion has received considerable attention, but few outstanding developments appear. Bohn's report on the effect of nitrogen on combustion of carbon monoxide at high pressure is a conspicuous exception. His work indicates that explosion of such mixture is accomplished with a low maximum explosion pressure and corresponding increase in efficiency of use under certain circumstances. The oxidation of the nitrogen which takes place suggests important possibilities as to fixation of nitrogen. Use of preheated air and of waste heat recovery systems also frequently add to efficiency of fuel use.

The decided tendency to coke ovens and vertical retorts instead of all other systems of coal carbonization is marked. These processes are being applied frequently to supply manufactured gas as a substitute for waning supplies of natural gas. Low prices for oil have stimulated oil-gas production in the West, but no new processes have appeared.

First Aid for Carbon Monoxide Victims

The steps in effective treatment of acute carbon monoxide poisoning are:

1. The victim should be removed to fresh air as soon as possible.
2. If breathing has stopped, or is weak and intermittent, or present in but occasional gasps, artificial respiration by the Schaefer method should be given persistently until normal breathing is resumed.
3. Pure oxygen, or a mixture of 5 per cent of carbon dioxide in oxygen, should be administered for 20 minutes or more, beginning as soon as possible.
4. Circulation should be aided by rubbing the limbs and keeping the body warm with blankets, hot-water bottles, hot bricks or other devices, care being taken that these are wrapped or do not come in contact with the body and produce burns. This aids in tiding the body over a period of low vitality. Other stimulants, such as hypodermics of caffein, sodium benzoate, or camphor in oil, should not be administered except by a physician after he has considered the possibility of overstimulation and consequent collapse.
5. The pateient should be kept at rest, lying down in order to avoid any strain on the heart. Later, he should be treated as a convalescent and given plenty of time to rest and recuperate.
6. After-effects of carbon monoxide poisoning should be treated symptomatically.

These are the recommendations made by R. R. Sayers, of the Bureau of Mines, as presented recently before the Pacific Safety Conference. Mr. Sayers has recently published a complete account of carbon monoxide poisoning. This appears in Bureau of Mines serial 2593.

Tile Tank Linings Investigated

An investigation is being carried on by the Bureau of Standards for the Associated Tile Manufacturers to determine the proper methods and material for lining tanks with tile. During the past month six more concrete tanks have been lined with vitreous tile and the corresponding sets of tile bars for transverse strength tests have been made. The grouting cement was a so-called natural cement. One tank of this series has now been filled with photographic fixing solution, one with photographic developer, and two have been filled with sulphurous acid (saturated solution). The effect of these solutions on the linings of the tanks will be studied.

Developments in Dextrine Manufacture

Conversion of Starch at Temperatures Higher Than Those Economically Attainable With Steam Yields a Lighter Colored Dextrine in Shorter Operating Time; Controlled Circulation of Flue Gases Gives Desired Temperature

By W. A. Darrah
President, Continental Industrial Engineers, Inc., Chicago

OWING to the extremely widespread application of dextrine and its products, the large volume of dextrine made and the relatively narrow margin of cost, it is of considerable importance to be able to produce the grades desired by the trade at a minimum cost and with a maximum of certainty.

Dextrine is manufactured by heating various kinds of starch with or without the presence of acids or alkalis. Heating is now usually accomplished in a stationary drum provided with an agitating mechanism and surrounded with some source of heat supply, such as steam jackets, pipe coils, etc.

Under present conditions some large producers work with starch containing 2 per cent or less of moisture, while others use a starch containing from 10 to 14 per cent of moisture. There are advantages and limitations to both methods, and the amount of moisture in the starch at the time conversion is carried out should depend upon the nature of the product desired, the operating temperatures, the apparatus and plant available and similar factors. The fact that starch containing less than 2 per cent of moisture is subject to a considerable explosion hazard is one factor that should be taken into account.

The amount and nature of the various acids employed in the manufacture of dextrine from starch have been standardized by experience, and in this operation the principal opportunity for improvement lies in the means of acidifying the starch, which is frequently rather crude.

The present methods of acidifying starch occasionally give overconcentration at some points and absence of acids at others. This condition has a tendency to make the final product spotty, produce specks, etc. A similar result is secured if the moisture in the starch is not uniformly distributed throughout the product. An excess of moisture at any one spot is likely to cause balling or lumping of the product, and this not only represents a loss of material but may lower the quality of the finished product unless special precautions are taken.

Temperature Control Difficult

Probably the greatest difficulty encountered under present operating conditions is that of maintaining a uniform temperature over the entire period of conversion, which may vary from less than 1 hour to 15 hours or even longer in some cases. Factors affecting the time are: Nature of the starch; amount of moisture in starch; amount and nature of acid added; and, most important, temperature.

As every dextrine manufacturer knows, there is a continual demand for special grades or types of dextrine, and one of the routine difficulties in the average dextrine plant is to match the qualities of a given grade of dextrine. A variation of 30 to 40 deg. F. in the conversion temperature may easily produce an entirely different product from that required, and a corresponding change in the time of conversion will frequently only partly compensate for the temperature factor. In the conversion process it is extremely desirable, therefore, that a constant and uniform temperature be maintained at all times.

Heat Transfer Presents a Problem

Agitation is of course important in the conversion of starch to dextrine, primarily for the reason that the starch is inherently a poor heat conductor, and unless the warmer starch is mechanically carried from the heat-transmitting surface and replaced by cooler starch, overheating is likely to occur in any type of dextrine apparatus. To state this fact in another way, it may be said that starch is an excellent insulator, and the temperature gradient between the starch in contact with the warm surface and the starch at the center of the converter is very high.

Any effective element that continuously and thoroughly mixes the starch will avoid difficulty in this connection. Proper engineering attention, however, must be directed toward this point, as it is a very simple matter for improperly constructed converters to form a layer or shell of carbonized starch on the heat-transmitting surface. The writer has seen layers of this kind that were nearly an inch in thickness and had reached a condition very similar in appearance to that of coke. Such a shell, of course, adds additional difficulties to transmitting the heat to the starch, thus causing losses of heat and also a lower production. A shell of this kind is also a source of specks and "dirt" in the dextrine, for the reason that it is continually shedding lumps and chips. From a practical standpoint, therefore, the agitating element of a converter requires careful attention both as to its design and as to its construction.

Horizontal and Vertical Converters in Use

Two types of converter are in common commercial use. One type is the horizontal converter, which consists of a steel shell 2 to 3 ft. in diameter and ranging from 10 to 20 ft. long. Shells of this kind are sometimes made U-shaped, in sections, with a flat cover, and sometimes are cylindrical in shape. The cylindrical shape is probably the more desirable of the two, and dextrinizers of this kind will give good results providing they are kept entirely clean and so constructed that no starch or dextrine remains in them

when the charges are removed. Any dextrine that is not removed with the main charge is almost certain to cause specks or dirt in the following charge. The agitator must have a very close clearance with the cylindrical shell in the horizontal type of dextrinizer.

From a practical standpoint it may be stated that the shell and ends of the converter should be thoroughly inclosed with a source of heat, particularly if a large amount of moisture is used in the starch from which the dextrine is made. If the heating means does not entirely surround all points of the shell of the converter, condensation is likely to occur at the unheated point, and drip from the condensed moisture back into the starch will cause balling and related troubles.

A second type of conversion drum, widely used in the United States and to some extent in Europe, is the vertical axis type of drum. This ordinarily consists of a cylinder 4 or 5 ft. high and 5 or 6 ft. in internal diameter. A cylinder of this kind is, of course, thoroughly insulated outside of the heat-transmitting shell and is usually provided with a gear-driven agitator suspended from the upper portion of the drum. An agitator of this kind should consist of a set of arms in one plane only. Step bearings or supports within the drum or below the drum are to be avoided, for

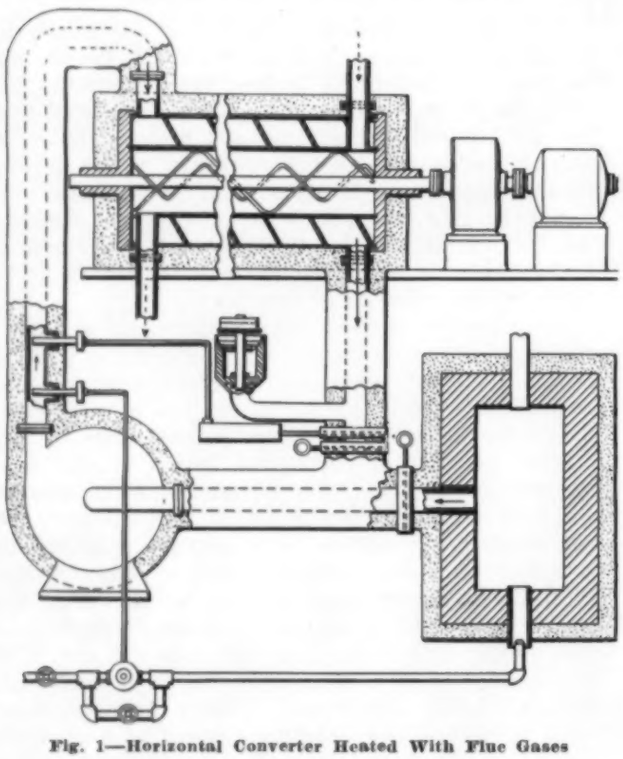


Fig. 1—Horizontal Converter Heated With Flue Gases

practical considerations, such as difficulty in lubrication, tendency of the bearing to become caked with dextrine, etc.

A new type of conversion apparatus has recently been developed, giving different results from those obtainable with equipment now on the market.

Heating by Circulating Flue Gases

The new conversion equipment, which is called the Continental system, is based upon a newly developed principle of burning fuel and circulating the hot products of combustion, under slight pressure, through the jackets, coils, etc., which it is desired to heat. This system is particularly applicable to the use of gas as fuel, but oil or even coal may be employed, although these latter fuels are not as flexible. Any type of gas may be employed, although city gas, natural gas or coke-oven gas are preferable because of their higher thermal content.

Briefly, the equipment is composed of a small combustion chamber, constructed of refractories and thoroughly insulated. Fuel is burned in the combustion chamber and is controlled by a thermostatic valve. A

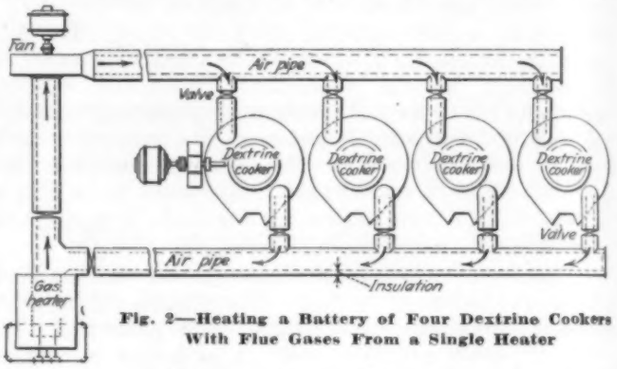


Fig. 2—Heating a Battery of Four Dextrine Cookers With Flue Gases From a Single Heater

blower is provided, capable of delivering the required volume of flue gases at a pressure varying under normal conditions from 5 to 10 oz., although this factor must be controlled by the design of each installation.

The blower is connected to the shell or jacket of the apparatus to be heated, as for example, the shell of the converter. In Fig. 1 a horizontal type of converter is shown. The agitator is motor-driven through worm gear reduction and the speed may be varied from 160 to 300 r.p.m.

The flue gases are drawn from the combustion chamber, automatically mixed with the returning flue gases that have circulated through the jacket, and are then delivered by the blower at a constant temperature to the jacket of the converter. The warm gases in traversing through the jacket give up a portion of their heat and are then after leaving the jacket mixed with an additional quantity of hot gases, which brings their temperature up to the original figure.

A relief valve is provided at the discharge end of the jacket and excess gases that collect in the system are exhausted through the relief valve. A thermostat is placed in the intake of the jacket and controls the amount of fuel burned in the combustion chamber. If the temperature of the circulating gases entering the jacket falls below the desired figure, more fuel is immediately burned in the combustion chamber and the temperature returns to normal. If the temperature of the flue gases entering the jacket is too high, the thermostat immediately closes down the fuel valve, thus consuming less fuel in the combustion chamber, and the gases return to normal.

It is possible to control within narrow limits (±3 deg. F.) temperatures as high as 1,000 deg. F. For dextrine manufacture, however, practical considerations limit the temperature to about 450 deg. F., although a few tests at 600 to 650 deg. F. gave most interesting results.

Fig. 2 shows a typical installation, in which one fan and combustion chamber unit supplies the circulating gases for a battery of four 2,000-lb. converters.

Fig. 3 shows a sectional elevation of a converter of the vertical axis type.

The advantages of any piece of commercial equipment are properly measured by the operating results. The system described has been very carefully studied under commercial conditions and a great many special and standard dextrines have been manufactured in it. The equipment shown in Fig. 4 normally holds from 75 to 150 lb. of dextrine, although for convenience the charges ordinarily did not exceed 100 lb.

Tests were made with practically dry starch; with starch containing about 12 per cent moisture; with starch free from acid or alkali; and with starch acidified with hydrochloric acid and with nitric acid. As these details are well known to dextrine manufacturers, they are not included in Table I, which emphasizes rather the effect of temperature. The temperature given is that of the wall of the converter. Under the heading "Gas Consumption" is given an arbitrary unit indicating the relative amount of fuel as read from the meter, without correction factors.

The results have been arranged in accordance with

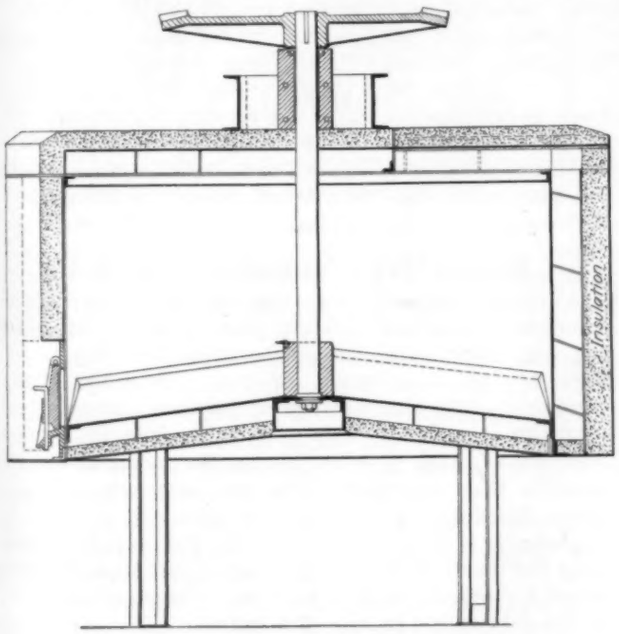


Fig. 3—Vertical Jacketed Dextrinizer

operating temperatures and the acid dextrines are grouped separately from the gums. The various dextrines and gums are graded in accordance with their commercial rating, which is largely a color grade. although other factors such as solubility and viscosity are also considered. The lightest product is designated by the letter *A*.

It is interesting to note that in the case of the acid dextrines as the temperature is raised from 350 to 450 deg. F. the time of conversion is shortened from 6 to about 3 hours. At the same time fuel consumption is reduced, although not of course in the same proportion, from 330 to 210 being a typical reduction. In making the darker gums the difference is even more pronounced. At 450 deg. F., for example, gum *E* can be produced in 3 hours, 34 minutes, as against 13 hours, 37 minutes when operating at 350 deg. F. That is, the same color gum (but with increased solubility) can be made in about one-third the time and with less than half the fuel required at the lower temperature.

It has been demonstrated most strikingly that the

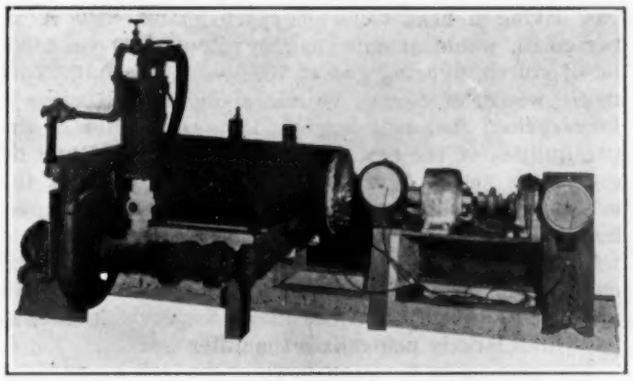


Fig. 4—Horizontal Flue Gas Heated Dextrinizer
Insulation has been removed to show connections more clearly.

higher temperatures will give a much lighter colored dextrine than can be obtained by the low-temperature methods. When it is considered that the major applications of dextrine are such that a yellow tinge is objectionable, the importance of this factor will be appreciated. For example, in the sizing of white goods, in the manufacture of food products, in the making of library paste, in gums, dyes and many other applications, a light color is a decided asset. The ability to produce dextrine having the desired physical characteristics, such as solubility and viscosity, in a much shorter time and with a much whiter color is of the utmost importance to the dextrine industry. The exact reasons for these results are now being studied, but the results have been conclusively demonstrated.

Because of the much greater production possible at the higher operating temperatures, it will be apparent that the investment for both building and equipment, in order to turn out a given production, will be materially reduced by reason of the new process. Based on complete tests that have been carried out over a period of several months, it would seem conservative to estimate that the first cost of equipment and buildings for a given production will be more than cut in half. This means, of course, a much greater production and greater income per dollar of investment.

At the same time the fuel economy of this system is extremely high owing to the fact that the only loss is a small amount of exhaust gas at a temperature of 400 to 500 deg. F. and of course the normal radiation, which is entirely within control by the application of proper insulation.

Based on a large number of tests, it would appear that the fuel cost for producing dextrine, using city

Table I—Effect of Temperature on Dextrine Production

Commer. Grades Dextrine	Temperature 350 Deg. F. Time Hr.	Min.	Gas Cons.	Sol.	Temperature 400 Deg. F. Time Hr.	Min.	Gas Cons.	Sol.	Temperature 450 Deg. F. Time Hr.	Min.	Gas Cons.	Sol.
Acid Dextrines:												
A	5	40	300	93.8	3	25	250	93.4	2	45	210	93.4
B	6	15	320	93.0	3	35	260	94.8	2	53	210	94.7
C	6	30	330	94.0	3	45	270	94.8	2	58	210	94.2
Gums:												
A	7	57	420	2.2	3	37	270	2.0	2	43	260	3.6
B	9	22	470	3.0	4	3	310	6.2	2	58	270	9.4
C	11	37	570	5.6	4	15	320	9.2	3	9	280	20.8
D	12	37	610	9.3	4	35	320	15.1	3	16	280	32.4
E	13	37	660	13.8	5	10	320	31.8	3	34	280	62.5

NOTE:—The commercial grades referred to above were determined by color, each sample being matched by a dextrine expert.

gas having a heat value of approximately 540 B.t.u. per cu.ft., would amount to only about 60c. per 1,000 lb. of starch, figuring gas at 70c. per 1,000 cu.ft. This figure would, of course, be materially reduced using a lower priced fuel, and is given as an indication of the possibilities of the new process. It has been found by comparing actual figures that in several instances the use of city gas gives a cost that quite closely approximates the cost of preparing the same quality of dextrine with steam generated under coal-fired boilers. Obviously, while coal is a much cheaper fuel per B.t.u. than gas, yet the much higher efficiency with which the gas is utilized largely neutralizes the difference.

The process in question is fully covered by pending patents.

SUMMARY

This discussion covers a newly developed process of preparing dextrine from starch. By this process it is possible to prepare a whiter grade of dextrine than has been previously manufactured. Dextrine thus prepared has all of the desirable characteristics of present commercial grades but a much lighter color, which greatly increases its value in the trade.

Dextrine may be produced with this process at a higher temperature and at a fuel saving over present methods.

With the new process, the time required to produce a given grade of dextrine is cut to one-half or one-third of the time at present required. By reason of the reduction of time, a given amount of equipment will produce from two to three times as much dextrine as present equipment of the same size. The new process, therefore, makes possible the production of dextrine with a much lower investment for equipment and buildings than present methods.

The writer wishes to express his appreciation of the courtesies extended by the Peoples Gas Light & Coke Co., the National Machine Co., C. H. Martin, and the dextrine users and manufacturers.

A Simple Method of Measuring the Flow of Liquids

By E. M. Jones

Research Chemist, Tennessee Copper Co.

A convenient method for measuring the flow of liquids in any kind of channel or pipe is the dilution method. The procedure is to add a known amount of a chemical to the liquid being measured, and then from the dilution that occurs calculate the volume of liquid. With the flow of the liquid constant it is necessary to maintain a constant addition of known solution. This is accomplished by means of a constant-head burette. This is a burette having a filling tube at the bottom and an overflow tube near the top. The solution runs into the burette just fast enough to keep it going out the overflow. The burette tip may be constructed so as to allow any speed of delivery.

Water is expensive, and the first step in economizing in its use is an accurate knowledge of the amount being used. Recently it was desired to compare the efficiencies of two types of acid coolers and it was necessary to know the amount of water flowing through each type. Due to the complicated piping, it was necessary to use the dilution method for the measurement.

The burette was set up at the discharge of the cooler coils with a reservoir of standard solution above it. The discharge of the burette, using the standard solution, was determined previously. The petcock was opened and time allowed for the mixture to reach the sampling point. Samples were taken at minute intervals. The solution used was sodium chloride. The samples were then analyzed for chlorides by a modified Volhard's method, and a blank run on the water itself. The concentration of chlorides taken for the calculation is the one that has reached a constant value.

The following table shows the results of one measurement. Time is counted from the time the solution is first added. The next column shows the total chlorides and the next one with the blank subtracted.

Standard NaCl solution..... 0.2650 g. NaCl per c.c.
Burette delivers..... 840 c.c. per minute
Burette delivers..... 222.6 g. NaCl per min.

Time (min.)	NaCl gms./liter	NaCl gms./liter	
0	0.0040 (blank)	.....	
1	0.1354	0.1314	
2	0.1380	0.1340	
3	0.1374	0.1334	.... 0.1340
4	0.1380	0.1340	
5	0.1328	0.1288	
6	0.0040 (blank)	.....	

The volume of water flowing per minute will then be $222.6 \div 0.1340 = 1{,}661$ liters per minute, or 111.1 tons per hour. The limit of error is not over 5 per cent.

French Match Monopoly Annulled

A recent dispatch from one of our French correspondents states that the final passing of the bill covering fiscal reforms in France brought about the acceptance of the abolishment of the government match monopoly. The manufacture of matches and their importation are henceforth practically free in France. The law of Aug. 2, 1872, giving the monopoly to the state is now abolished. The new law expressly prohibits the forming of a private monopoly or trust in conformity with article 419 of the Penal Code forbidding the "reunion or coalition" which attempts to bring about for private profit a regional or national monopoly of the fabrication or sale of matches.

The bill states that in case the government re-establishes the match monopoly it will buy of the existing manufacturers their buildings, equipment, patents and licenses at what they might bring at market quotations and that no bonus or indemnity will be paid in addition.

Important details remain to be adjusted relative to the discharge and compensation of the personnel of the former government match factories, as well as the general lines of imposing and collecting the taxes now imposed on private enterprise. These details will be fixed by a decree which will be put in force within 6 months by the Minister of Finances.

The government match factory of Aix en Provence, installed originally according to the American system, is said to have been the only plant efficiently producing matches in France, the six other plants being heavily overmanned and producing but small output.

Already advertisements of German machinery for making matches are appearing in the French technical press. These suggest that a new industry may be born and that on general lines its equipment and operation are such that it may well be of interest to American producers of match-making machinery and to American exporters of matches.

Equipment Developments in the Contact Sulphuric Acid Process

The Marked Changes That Have Taken Place During the Twenty-Five Years of the Life of This Process Are Described and Evaluated

By F. C. Zeisberg
Chemical Engineer, E. I. du Pont de Nemours & Co., Wilmington, Del.

THE contact sulphuric acid process does not enjoy the ancient lineage possessed by the nitric acid process just discussed, having been put on a commercial basis only as recently as 1900. Consequently the development of this process has not passed through as many stages as was true of the older process, but nevertheless the development has been considerable, and many improvements have been made.

The contact sulphuric acid process consists of the following steps: first, the production of a mixture of sulphur dioxide and air, usually by burning iron pyrites or sulphur; second, the forcing of this mixture over a catalyst maintained at an elevated temperature, whereupon the sulphur dioxide burns to sulphur trioxide, and third, the cooling of the resulting gas and absorption of the sulphur trioxide to form sulphuric acid.

It is of course necessary to purify the burner gas very carefully, in order to insure long life of the catalyst, and to dry it in order to avoid the condensation of sulphuric acid in the converter gases and the consequent corrosion of the flues and pipes in which this gas is handled.

The unit processes in this case are combustion of the sulphur and pyrites, gas purifications, gas drying, gas catalysis, and absorption.

Combustion, or the burning of sulphur and pyrites, has absorbed the interest of chemical engineers for many years. For our purposes the burning of sulphur alone will be considered, this being sufficiently typical of the process of combustion. The earliest sulphur burners were simply pans of various sizes, inclosed in suitable settings, into which the sulphur was shoveled, melted by the heat of its own burning and then vaporized and burned off.

The objections to the pan type of burner, of which there are many designs, are the low capacity for a given floor space, the difficulty of regulation and the difficulty of cleaning the pans while in operation. To overcome these objections several modifications of pan burners have been developed, in which, for example, several pans have been superimposed in order to produce a more compact design. The Vesuvius burner, manufactured by the Valley Iron Works, Appleton, Wis., is a burner of this type. Several circular pans are inclosed in a cylindrical casing. Sulphur is charged into the top pan, which is open to the air, and there it melts from the heat of the sulphur burning in the pans underneath. The rate of admission of the melted sulphur to the burning pans is controlled by a needle valve in the bottom of the melting pan, and the rate of burning and the strength of the gas by the amount of air drawn in through the dampers with which each pan is provided. Each pan overflows to the pan beneath, so that burning occurs simultaneously on all pans.

Another ingenious method of producing a compact design is exhibited in the sulphur burner of Tromblee and Paull, manufactured by the Glens Falls Machine Works. The amount of sulphur burned in unit time is directly proportional to the amount of air that can come in contact with the molten sulphur. This in turn depends on the area of molten sulphur exposed to the air and the rate of flow of the air. Fig. 1 shows how the area of the molten sulphur has been extended in the Tromblee and Paull burner. The burner is a horizontal, cylindrical shell rotated slowly. The molten sulphur, owing to its viscosity, clings to the inside of the shell and is carried up, exposing a large surface. As the film approaches the top of its travel, it tends to collect in drops that rain down throughout the length of the cylinder, still further increasing the area of molten sulphur.

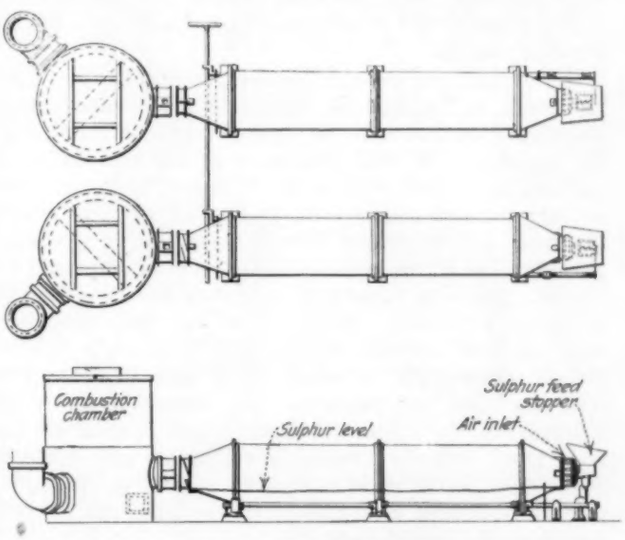


Fig. 1—Glens Falls Sulphur Burner

Heat is generated so rapidly in the burner that it tends to vaporize sulphur more rapidly than it can be burned. Consequently the gas passing from the cylinder consists of a mixture of sulphur dioxide, nitrogen and sulphur vapor. Additional air is mixed with this gas stream as it leaves the burner cylinder and the

From a lecture given at Carnegie Institute of Technology, Pittsburgh, Pa., March 21, 1924.

combustion is completed in a combustion chamber connected with the burner.

This type of burner is best suited to the very pure sulphur mined by the Frasch method in Louisiana and Texas, because only occasional cleaning is necessary to remove the ash that accumulates in the revolving cylinder. This cleaning can be accomplished only by allowing the sulphur to burn out and then scraping the ash out with long-handled hoes.

A recent burner designed to handle sulphur high in ash has been patented by Chickering. (U. S. Pat. 1450677.) The inclined, cylindrical casing in this type is stationary, the ash being advanced up the incline by the slow revolution of the stirrer arms with which the central shaft is provided. This burner has successfully handled sulphur containing as high as 15 per cent ash, continuously discharging an ash containing less than 1 per cent sulphur.

There are numerous other systems of burning sulphur in use, such as the burner of Hurt (U. S. Pat. 1289783, Dec. 31, 1918), in which a pool of molten sulphur is maintained, while a jet of compressed air is introduced beneath the surface, causing a column of burning molten sulphur to rise to a greater or lesser height, depending on the velocity of the air jet. But it would seem to me that the next development in the burning of sulphur would be likely to follow the lead indicated by Heckenbleickner (U. S. Pat. 1464527, Aug. 14, 1923), who melts his sulphur and then handles it like a liquid fuel in equipment originally intended for burning fuel oil.

Gas drying and gas purification are highly specialized processes, as applied to sulphuric acid manufacture, and the equipment must be designed quite as much from the standpoint of acid resistance as for the particular purpose for which it is used. It seems, therefore, that no very general conclusions, as applied to other manufacturers, can be drawn from a discussion of the many varied pieces of apparatus that have been employed for this purpose, and these unit processes will hence not be discussed in detail. Suffice it to say that equipment used for this purpose includes gas bubblers, scrubbing towers, coke-boxes, asbestos filters and, recently, Cottrell electrical precipitators. The criterion for a gas suitable for the contact process is that it must be dry, free from volatile arsenic compounds, and optically pure—that is, it must not make visible to the eye a powerful beam of light passed through the gas at right angles to the line of sight.

Catalysis in this process consists simply in bringing the purified burner gas into contact with platinum supported on a suitable carrier. The first contact plants used asbestos as a carrier, and the catalyst was placed in a group of tubes arranged very much like those of a multi-tubular condenser. As the reaction does not begin until a temperature of about 400 deg. C. is reached, these tubes were heated from the outside with gas flame. Preheating and conversion were thus accomplished in the same apparatus.

The development in this case took the form of a separation of these two processes, the preheating now being carried out in a separate preheater preceding the converter. By this means a better control of the temperature is achieved. The earlier form of converter, containing the catalyst in a bundle of tubes, has also been abandoned for a tray type converter in all except the Tentelev process. The objection to tubes is that the gas resistance through them is high, and the tubes are hard to load and unload. The tray converter is much easier to load and the gas resistance is much lower.

There is very little opportunity to exercise any but the simplest chemical engineering principles in the design of an apparatus so simple as a converter, and consequently the types now in use exhibit very minor differences. In general a converter is only a cylindrical container of cast iron or steel, containing several trays on which the contact mass is supported. The mass itself is now either calcined magnesium sulphate or asbestos. Both are good, but magnesium sulphate offers less gas resistance and is easier to place, where only unskilled labor is available for this work.

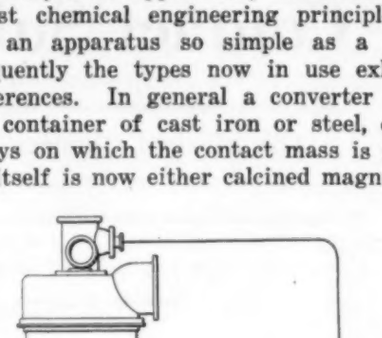


Fig. 2—Sulphuric Acid Scrubber and Absorber

Since the burning of sulphur dioxide to sulphur trioxide is accompanied by the evolution of more heat than is necessary to raise the cold, purified burner gas to the temperature at which the reaction is initiated (about 400 deg. C.), chemical engineers have naturally long been interested in recovering this heat by means of heat exchangers. One system of accomplishing this recovery is the system invented by Herreshoff (U. S. Pat. 719333, Jan. 27, 1903). The gas passes first in series through the two exchangers, passing down through the tubes. It passes next through the right-hand converter, then through the right-hand exchanger, outside the tubes, where it gives up heat to the incoming gas and is cooled to the proper temperature to enter the second converter. It passes from this second converter through the left-hand exchanger, outside the tubes, and gives up its heat to the cold, purified burner gas first entering the system. Valves are provided, that bypass cold gas and can be used in regulating the temperatures of the gas entering the converters.

Installations incorporating this principle have been in successful use for many years. Those improvements which have been made have been mostly in the nature of refinements in the heat exchangers, so that much smaller and cheaper exchangers now suffice to do the work formerly done by large and expensive apparatus. It is doubtful whether any material departure from this design is likely to occur in the near future.

The burner gas that has passed through the converter now contains its sulphur content almost wholly in the form of gaseous sulphur trioxide. To convert

this to sulphuric acid the gas must be cooled and must be allowed to come in contact with water, always supplied in the form of strong sulphuric acid, which reacts with the sulphur trioxide and converts it to liquid sulphuric acid. Heat is liberated in this absorption, so that means must be provided to remove this heat or the efficiency of absorption will be diminished.

In the early days of the contact process this absorption was carried out in horizontal cylindrical tanks half filled with the absorption acid, and the gas stream was passed through the tanks lengthwise, over the surface of the acid. Sometimes the heat liberated was allowed to dissipate simply by conduction and convection to the air, sometimes a shower of water was run over the outside of the tank. In either event the absorption and cooling were poor, the same remarks applying here that applied in the case of the tourills used in nitric acid manufacture, and the gas had to be passed very slowly through the absorbers to prevent losing sulphur trioxide out of the exit.

In fact, this exit loss was the necessity that drove designers to the very efficient modern absorption system. In order to prevent this exit loss a shower absorber was placed just before the exit. This was a tower through which a shower of sulphuric acid was pumped. This tower later had packing added, to insure more intimate contact between the acid and the gas; and a cooler in the acid-circulating system to keep the temperature of the acid down. Fig. 2 shows a modern sulphuric acid absorption tower, acid cooler and pump, and absorption systems nowadays are made up of a number of such units, variously arranged to suit special conditions.

The foregoing hasty outline gives a rough idea of the general trend of design in these two important manufacturing processes. Some of the improvement came about because of the development of new materials of construction, but the most noteworthy were those resulting from a clearer understanding of the fundamental principles. It is gratifying, in reviewing the various outstanding steps forward in these two processes, such as the invention of the Hart condenser and the application of the heat exchange principle in the contact sulphuric acid process, to note that many of these were made by American chemical engineers. May the future show that in the many further advances in chemical engineering that are bound to come, the American chemical engineer will continue to keep well to the fore, as he has in the past!

Preparation of Super-Refractories

An investigation having for its purpose the production, by electric furnace methods, of materials of higher refractoriness than those commonly used in commercial practice is being conducted by the Department of the Interior at the Seattle, Wash., experiment station of the Bureau of Mines. Such refractories have been called super-refractories. The first material to be investigated is sillimanite. Two methods of preparing the material are being studied—namely, (1) from a mixture of clay and aluminum oxide in the form of bauxite, diaspore, or alunite residue; (2) from clay alone by removing the requisite amount of silica and the iron by melting with carbon in the electric furnace. The material thus produced in the electric furnace is then subjected to the methods of testing refractory materials and is fashioned into brick and other shapes and given both refractory and commercial tests.

Encouraging progress has been made in this investigation. It is expected that the work on sillimanite will be completed during the present fiscal year and that another material will be taken up.

Industrial Uses of Titanium

Although rutile (titanium oxide) has a wide range of uses and is used in many industries, the total consumption of it is so small as to preclude its being produced on a large scale, and consequently it has always been rather a costly article compared with minerals of other metals.

Ralph B. Williams, writing in a recent issue of the *Engineering & Mining Journal-Press*, explains that all the rutile that has been used in this country during the last 20 years has been supplied by the American Rutile Co. from its Virginia property. It has been used as a constituent part of electrodes for arc lights, as titanium dioxide in the form of rutile gives the best specter in arc light electrodes; in the form of titanium potassium oxalate and titanium sulphates as mordants in the dyeing industry, particularly as a mordant in leather; in the manufacture of glass; in the ceramic trade for glazes and tile work, and in glazes for acid-resisting material; in enamels, in the manufacture of enamels for artificial teeth; and it was also used during the war as a smoke screen in the form of titanium tetrachloride, being first treated in an electric furnace and that product chlorinated to make titanium tetrachloride—which material stood about No. 3 in its value as an obscuring medium. It has also been used in many alloys, such as manganese-titanium, cupro-titanium metal, and others.

Ilmenite ($CaTiSiO_5$) is largely used to manufacture white titanium oxide for paint, carbon-free ferrotitanium, and ferrocarbon titanium. White titanium oxide for paint is the outgrowth of experiments in this country and Norway for many years, and it is being manufactured and marketed by subsidiaries of the National Lead Co.

Considerable interest has been shown and much research work has been done on rutile in the last few years, and results have been obtained which indicate that probably new uses will be found for this material, some of which will make use of properties long unsuspected as characteristics of the mineral. This is particularly true in the field of titanium as a metal and alloy, and rutile as a refractory for the manufacture of certain necessary articles, and rutile as a conductor of heat and electricity.

Ilmenite concentrates of high-purity titanite have varied in price from $15 to $25 per ton, f.o.b. north Atlantic ports; and bulk ilmenite from Canada of lower-grade titanium content has varied from about $5 to $10, f.o.b. points of entry on the northern frontier. The price of rutile during the last few years has varied from 10c. to 25c. per lb., depending on quantity, quality, fineness, color and some other factors, for concentrate of 95 per cent titanium dioxide content; but the production of it can be easily increased to meet any new market demands and its cost correspondingly decreased when a real tonnage of rutile is needed for commercial purposes.

Electric Motors for Driving Centrifugal Water Pumps

A Comparison of the Cost of Pumping Water by This Method, Using Central Station Current, With Steam Turbine and Engine Drives

By Erik G. Sohlberg
Construction Engineering Department, General Electric Co.

LARGE users of pumped water, contemplating new installations or extensions to existing pumping plants, generally find it more economical to install motor-driven centrifugal pumps, purchasing power from some local electric service corporation, than to build and operate small isolated boiler and pumping plants with steam-driven pumps.

There are several reasons for this circumstance:

(1) Lower first cost of the electrically operated pumping plant.

(2) Lower fixed charges.

(3) Lower cost of maintenance.

(4) Lower cost of operation.

(5) Inherently higher thermal efficiencies of the relatively larger units in a central station as compared with the smaller units in the isolated plant, which more than make up for the losses of conversion and transmission.

The net result is lower cost of water supply.

Considering a pumping plant of about 30,000,000 gal. per day capacity and equipped with two pumps of approximately this capacity for alternate service and to meet peak loads, the relative first costs, fixed charges, maintenance, operation and cost of water pumped could be expected to line up about as shown in the following tabulation for the three plants now commonly in use:

(*a*) The pumping plant using plunger pumps driven by means of reciprocating engines with boiler plant.

(*b*) The pumping plant using centrifugal pumps driven by means of highly efficient steam turbines specially developed for the purpose, including a somewhat smaller boiler plant.

(*c*) The pumping plant equipped with electrically driven centrifugal pumps, including necessary switching and transformer equipment.

	Column 1 Boiler Plant Reciprocating Engines and Plunger Pumps	Column 2 Boiler Plant Turbine-Driven Centrifugal Pumps	Column 3 Motor-Driven Centrifugal Pumps With Full Automatic Operation
First cost:	Per Cent	Per Cent	Per Cent
Boiler plant.....	100	90	0
Pump plant.....	100	40	25
Fixed charges:			
Interest, depreciation, insurance.	100	65	12.5
Maintenance....	100	65	5
Operation costs:			
Fuel or elec. energy.....	100	90	275
Labor and supervision	100	90	10
Cost of water pumped.....	100	77.5	75.5

HANDLING LIQUIDS

Much has been written on both the theory and practice of pumping liquids. However, there has been a dearth of actual cost information that can be used by an engineer in selecting the most economical figures. An easy method of comparing costs of different systems is given in the accompanying article. While the exact figures chosen as a basis of comparison will not hold for all cases, it should be simple for the engineer to substitute his own figures and thus apply the method to his problem.

A UNIT PROCESS OF CHEMICAL ENGINEERING

The relative costs of fuel and electric energy are based on 13,000 B.t.u. coal at $3.20 per 2,000 lb. and 1.2c. per kw.-hr. at the motor. In column 1, a pound of coal is assumed to give 950,000 ft.-lb. output of pumps and in column 2, it is assumed to give 1,060,000 ft.-lb. In column 3, 1 kw.-hr. input to motor is assumed to give 2,040,000 ft.-lb. output of pumps, or an over-all thermal efficiency of 2,040,000 ÷ 2,655,220 = 77 per cent, 2,655,220 ft.-lb. being the mechanical equivalent of 1 kw.-hr.

First Cost—The initial investment represented by the engine-driven pumping plant is quite high and cannot be justified when compared with plants using turbines or motors.

The steam turbine-driven centrifugal pump is the proper equipment to install where electric energy at low cost is not available. The first cost of the complete plant is relatively low, about 90 per cent for the boiler plant and 40 per cent for the pumping plant.

The motor-driven centrifugal pump requires no boiler plant with coal- and ash-handling equipment, no condenser with auxiliaries, no high- or low-pressure steam piping; it is by far the lowest priced and most efficient means of handling water. The units are quite compact, requiring only a small housing. For the comparative first cost 25 per cent is considered conservative.

Fixed Charges—The relative fixed charges to cover interest, depreciation and insurance are in direct proportion to the total first cost of the plants.

Maintenance — In the tabulation the relative expense for maintenance is taken at 5 per cent of the first costs for the steam pumping plants and at 2 per cent for the electric. Maintenance of boilers, stokers, piping engines or turbines runs proportionately much higher than that for electric motors and switching equipment.

Costs of Operation—The fuel consumption in plants of the character referred to in column 1 averages 950,000 ft.-lb. output of pump per lb. of coal (13,000 B.t.u.).

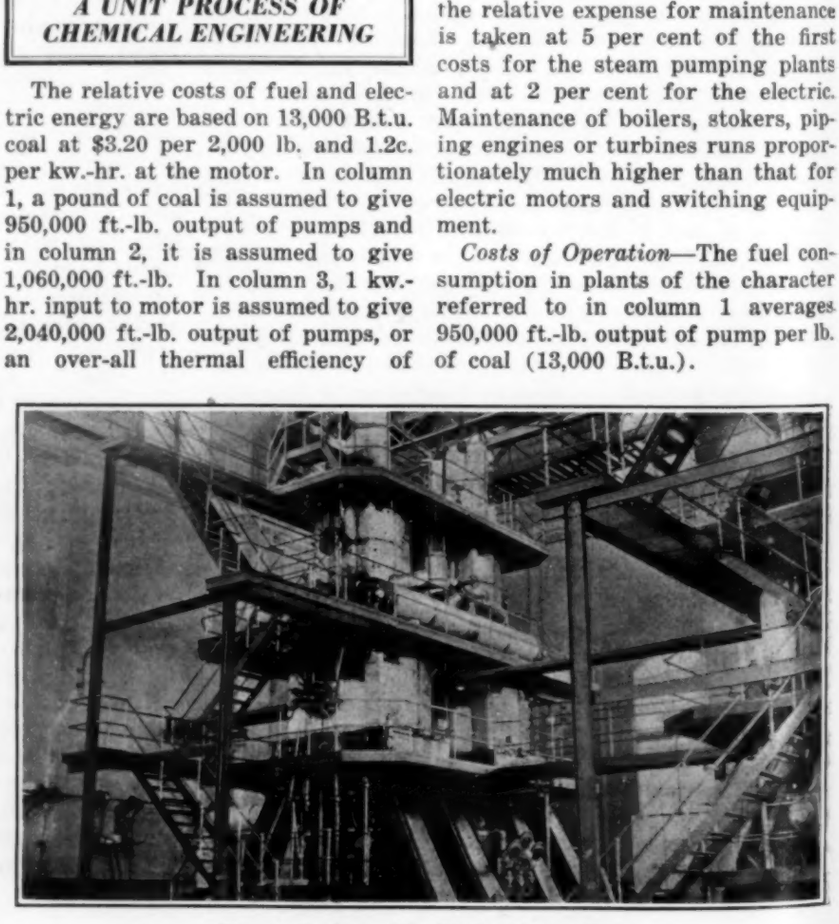


Fig. 1—Reciprocating Engine-Driven Pump

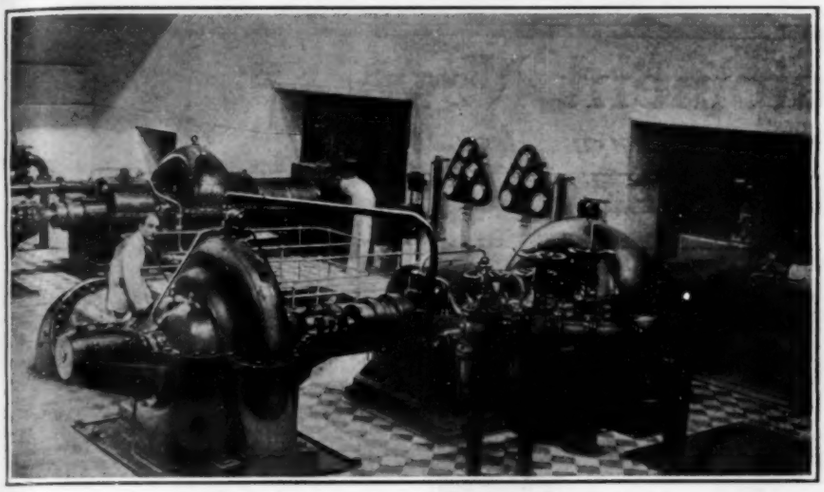


Fig. 2—Centrifugal Pumps With Turbine Drive

The corresponding figure for the plant in column 2 is 1,060,000 ft.-lb.

Large central stations today manufacture 1 kw.-hr. at the bus from less than 19,500 B.t.u. heat value of coal or from 1½ lb. of 13,000 B.t.u. coal. With power supplied from such a station and pumping water with motor-driven centrifugal pumps as contemplated for the plant in column 3, the successive steps of conversion would line up about as follows:

(*a*) 1 lb. 13,000 B.t.u. coal = 0.67 kw.-hr. at the bus. Now, assuming 10 per cent losses in transformation and transmission, we get

(*b*) 1 lb. coal = 0.9 × 0.67 = 0.603 kw.-hr. input to motor, and assuming 93 per cent efficiency of motor, we get

(*c*) 1 lb. coal = 0.93 × 0.603 = 0.54 kw.-hr. input to pump. Then, assuming 82 per cent efficiency of pump, we get

(*d*) 1 lb. coal = 0.82 × 0.54 = 0.442 kw.-hr. output of pump.

Further, the mechanical equivalent of 1 kw.-hr. = 2,655,220 ft.-lb.; therefore

1 lb. coal = 0.442 × 2,655,220 = 1,170,000 ft.-lb. output of pump.

Comparing this with the output per pound of coal for the steam-driven station, we find a considerable margin for profit to be divided between the central and the water supply station.

In addition a water supply system operated with motor-driven pumps and ample reservoir capacity constitutes an exceptionally desirable load for any central station, since it may be made an "off-peak load" by proper proportioning of the capacity of the pump units. These must then be large enough to handle all water during the "off-peak" hours. The reservoirs must also have sufficient capacity and elevation to supply the maximum amount consumed during the hours of peak loads on the central station. Under such conditions, the water supply station should be able to secure a very favorable contract for electric service.

The labor items for the steam-driven pumping plants are quite high, mainly due to the boiler equipment. It would no doubt run slightly lower for the turbine-driven plant than for the engine-driven plant.

The electrical pumping plant may be designed for full automatic operation, requiring only occasional attendance without sacrificing reliability.

Cost of Pumping Water—As a very general rule it may be stated that where electric service is available the lowest cost of pumping water is by means of motor-driven centrifugal pumps.

In cases where the motors can be connected to large electric power distributing systems fed from a number of central stations and hydro-electric generating stations, further benefits automatically accrue as new, more and more efficient stations are added on the system or the older ones improved. The isolated plant does not have this opportunity, but must gradually fall behind in economy until the expense for extensive improvements can be justified.

This statement is borne out by statistics, which prove that electric energy is steadily decreasing in cost, while all other commodities, including coal, are increasing.

Numerous benefits to the community would result from the installation and operation of motor-driven centrifugal pumps.

(*a*) The capacity factor on the central station will be appreciably improved, resulting in lower cost of all electric energy.

(*b*) The cost of pumping water will be reduced to a minimum and will be still further reduced as more and more efficient generating equipment is brought out and installed in the stations, pumping electric energy into the distribution systems.

(*c*) A saving in total coal consumption. It is becoming more and more apparent that the fuel resources must be conserved. This is best accomplished by concentrating consumption where greatest thermal efficiency may be obtained, such as in central stations.

(*d*) No coal and ash to handle at the pumping plant, where the water must be kept as pure as possible.

As proved by numerous articles in the technical press in the last few years, even old steam-driven pumping plants have been changed to all-electric or extended with electric units, resulting in great savings in cost of water pumped.

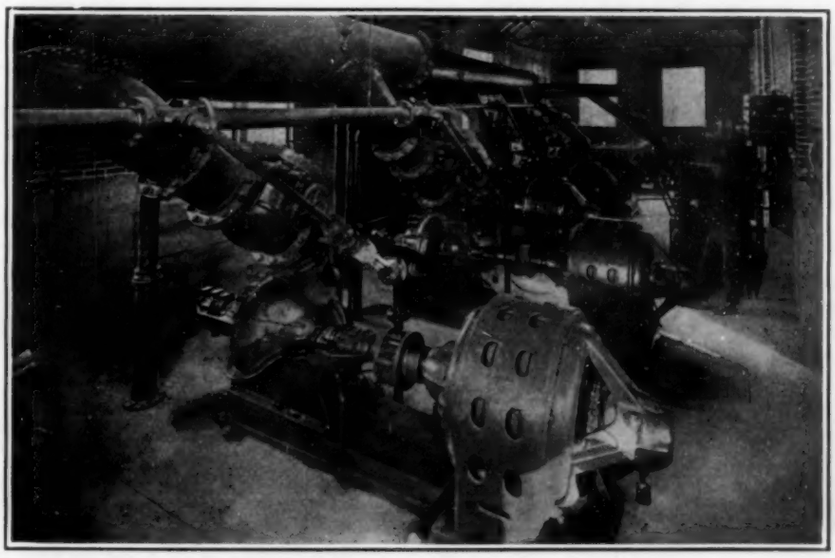


Fig. 3—Motor-Driven Centrifugal Pumps

Equipment News

From Maker and User

Improved Movement for Recording Instruments

Permanent Calibration for Helical Tube Accomplished Through New Method of Manufacture

A recent improvement in the helical tube type of actuating movement for recording instruments has been made by the Foxboro Co., Inc., Foxboro, Mass., which claims that it will prove of pronounced importance to those who rely upon records to control production. The principles upon which this design and construction are based are the result of several years effort, during which hundreds of tests were necessary to prove its ability to meet the widely varying conditions of service that industrial temperature and pressure recording instruments have to face. Then, after the experimental movements had proved themselves thoroughly satisfactory, it was necessary to work out manufacturing methods that would assure perfect reproduction of the original movement in quantity.

The secret of the improved movement lies in a new method of drawing, shaping and tempering the helical tube (see Fig. 1), which, in these recording instruments, is the vital part of the movement. This method makes possible a tube having several remarkable properties, affecting not only the performance of the instrument but the entire design of the movement.

The most important characteristic claimed for the improved helical tube is that it is permanent in calibration. This is, of course, a feature that can hardly be overestimated in view of its effect on the reliability and accuracy of temperature and pressure records. It is claimed that tests equivalent to years of strenuous service have failed to indicate the slightest sign of "fatigue" in these tubes. From the standpoint of design it has become possible to dispense with the numerous adjustments required in all other movements. Since adjustments inevitably create friction or introduce lost motion, this is a decided advantage. The striking simplicity of the movement is clearly indicated in the illustration. The manufacture of these tubes has been so perfected that every tube has known characteristics. It is possible to substitute one movement for another without recalibration.

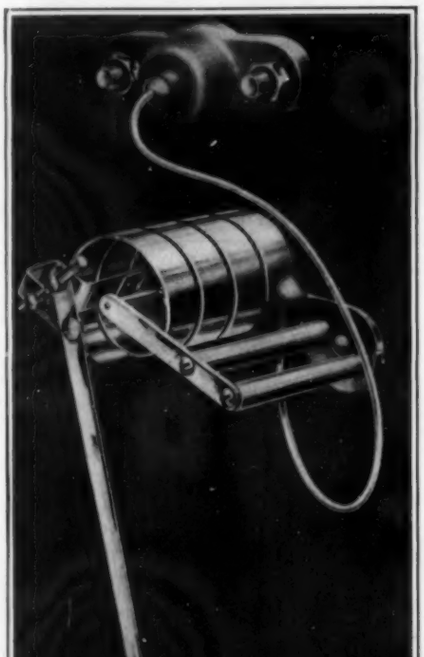


Fig. 1—Helical Tube Movement for Recording Instruments

Another valuable quality claimed for the helical tube is its unusual strength. It will not split, leak or crack under the severest service conditions. It may be subjected to excess pressures that carry the pen way beyond the outer edge of the chart without weakening or loss of accuracy. The test pictured in Fig. 2 is an interesting proof of this statement. A 12-in. chart was placed on the regular 8-in. recording gage and the pressure raised until the pen moved to the outer edge of the 12-in. chart. This is equivalent to an overload of 100 per cent. The chart record shows that when the pressure is reduced to zero, the pen returns at once exactly to zero, proving that the tube has not set. This extreme test has been repeated many times without affecting the accuracy of the movement in the least.

The remarkable strength and elasticity of the improved helical tube movement are perhaps most strikingly illustrated by the reproduction of an actual record (Fig. 3) of pressure in a Jefferson vomiting kier, made at the Lincoln Bleachery, Lonsdale, R. I. It is estimated that the pen arm moves up and down 16,000 times a month, yet the movements of the several Foxboro recorders producing charts similar to this have shown no sign of weakening or loss of accuracy after months of continuous service.

Thus it is evident that the ordinary scale restrictions are unnecessary. It is possible to select the scale range that is easiest to read and use the instrument constantly at maximum range if desired. No limited "working range" is specified.

Referring back to Fig. 1, it should be

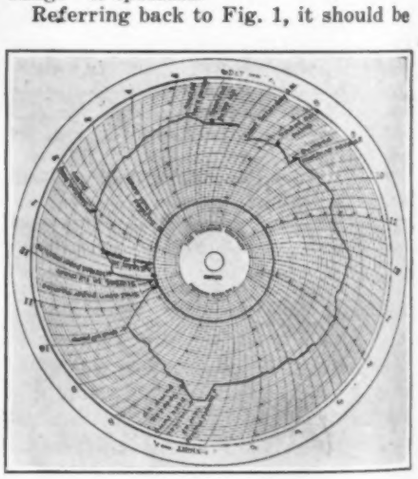


Fig. 3—Chart of Pressure on a Jefferson Vomiting Kier at Lincoln Bleachery

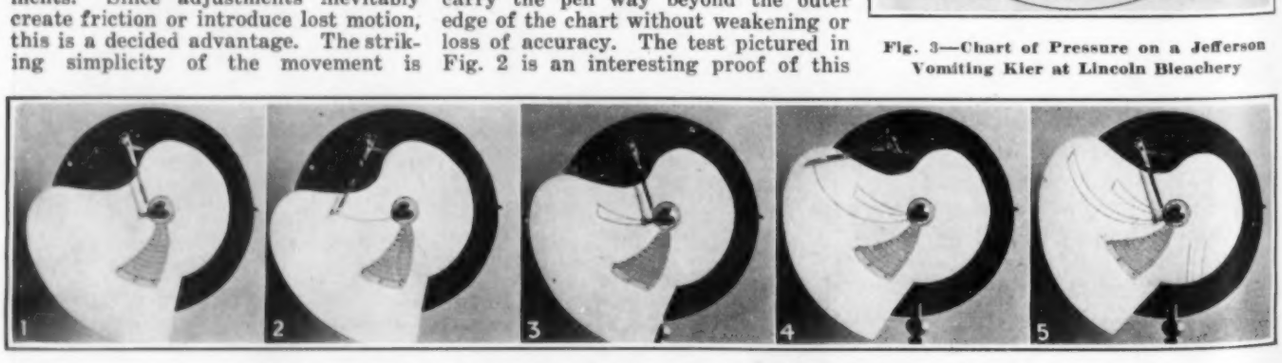


Fig. 2—Testing Showing 12-In. Chart on 8-In. Recorder

Reading from left to right: 1—Pen at zero. 2—Pen at 100 lb. 3—Return to zero. 4—Pen at 200 lb. 5—Return to zero.

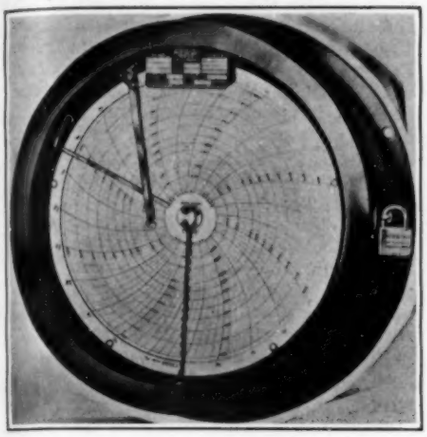


Fig. 4—Helical Tube Model of Recording Thermometer, Showing Compactness

noted that the construction provides a fixed axis of rotation for the pen arm so that it always follows the arc of the chart. This, of course, adds to the accuracy of the instrument. It has been conclusively demonstrated that the accuracy of the improved helical tube movement is within 1 per cent of total scale reading at all points of the scale and for all scale ranges. The compactness of the movement makes possible the use of the standard round form case illustrated in Fig. 4.

Combustion Controller

A new device for the control of combustion in boilers and furnaces has recently been devised by George A. Brooke, Jr., and William C. Longstreth, of Philadelphia, Pa. This device, called the Brooke boiler controller, consists of two inverted bells inclosed in separate chambers and sealed with oil. Furnace draft is piped to the upper side of one bell and to the under side of the other. Atmospheric pressure is admitted above the first bell and under the second. Due to this balancing of the bells, changes in oil level have no effect on the accuracy or sensibility of the instrument. These bells are connected to an arm, which passes through the oil chamber above the level of the oil, thus avoiding the necessity of packed glands.

Rigidly connected to this pivot arm, but outside of the oil chamber, is a threaded arm which carries two electrical contacts. A slight movement of the bells forms a contact on one side or the other, and this actuates a magnetic contactor. Through this electrical contact, a reversible motor is caused to operate, and this actuates a gear train. This gear train connects to a main shaft, on which are pulleys controlling the dampers through belts. It is claimed by the makers of this device that constant draft at any predetermined point may be maintained with only extremely slight variations. It is also claimed that this controller has been put to severe test by several large concerns, such as the U.G.I. Contracting Co., of Philadelphia, and that the results obtained have been satisfactory. The device is marketed by F. W. Rockstraw Co., Henry W. Oliver Building, Pittsburgh, Pa.

Pre-Mixer for Air-Gas Combustion

The great expansion of the industrial use of city gas that has taken place during the past few years is largely due to the burden which industries have encountered in the use of other fuels and to the realization of the many advantages to be secured by the use of gas in mechanical heating operations. In many respects industrial gas is an ideal fuel. No storage bins are required as is the case with coke and coal, nor tanks as when oil is used. It leaves no ash. It is not hampered by electricity's high cost.

Many of the difficulties that have been encountered in the past with the use of gas can now be largely eliminated by the installation of the proper equipment. One device recommended for this purpose is the Reeves gas-air pre-mixer manufactured by the Industrial Gas Equipment Co., New Haven, Conn. It is an apparatus that mixes with air in one central station all of the gas used in a given factory and delivers this non-explosive mixture through one pipe to the various burners throughout the plant. The essential and exclusive features of this device are that it maintains automatically and continuously the exact predetermined proportions of gas and air and maintains a constant flame temperature regardless of varying atmospheric and gas pressures and varying conditions of load. The constant proportions are maintained by first reducing both the gas and air to a pressure slightly below atmospheric pressure in the mixer and then passing these elements through ports or openings of the desired proportions into the mixing chamber.

The gas-air mixture is then put under positive pressure in the pump. When the flame in any appliance is turned down or out, the pressure in the pump is automatically relieved by a bypass back pressure valve which passes the surplus mixture back. The valves in the mixer then close automatically to pass only the quantity of gas and air required.

From the same service pipe any size of flame may be obtained in any appliance and will continue at even size and temperature irrespective of what flame or volume of gas is being used by other appliances.

The different qualities of flame required in various furnaces and appliances are obtained by the scientific but simple method of regulation at the burners.

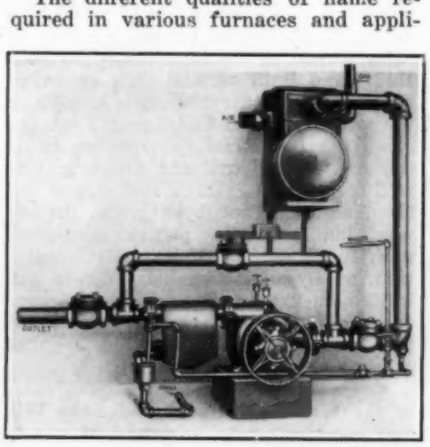


Fig. 1—Pre-Mixer for Air-Gas Combustion

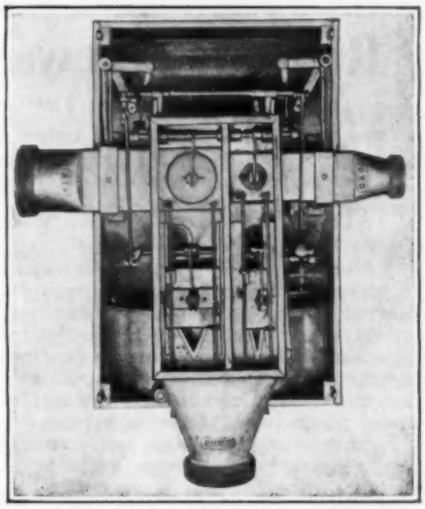


Fig. 2—Installation of Pre-Mixer With Hy-tor Compressor

The setting up of this apparatus is simple. It requires little floor space and no expensive foundation. The installation may be relied upon to give years of service without attention other than lubrication. The pre-mixing apparatus contains no gears, pistons or similar devices, and as the operating parts move only under change of gas or air pressure, the wear is slight and the mechanism practically trouble-proof.

Manufacturers' Latest Publications

C. M. S., Inc., Tarrytown, N. Y.—A bound volume of C. M. S. bulletins from No. 100 to No. 111, covering flow motors, spray booths, varnish ovens, enameling and japanning ovens, finishing ovens, ovenettes, conveyors, electric heaters and relays.

Combustion Engineering Corp., 43 Broad St., N. Y. City.—A reprint of a paper given before the December, 1923, meeting of A.S.M.E. by C. W. E. Clarke, of Dwight P. Robinson & Co., engineers, describing boiler tests with preheated air at the Colfax station of the Duquesne Light Co.

Davenport Locomotive Works, Davenport, Iowa.—A folder on Davenport gasoline locomotives for industrial use.

Sullivan Machinery Co., Chicago, Ill.—Bulletin 78-B. A new bulletin on various sizes and designs of dry vacuum pumps.

Steere Engineering Co., Detroit, Mich.—Pamphlet 260. A leaflet on Steere steel pipe and fittings for water, gas, steam and air.

Pacific Foundry Co., San Francisco, Calif.—Bulletin 60. A catalog of globe and plug valves made of cast iron, "Corrosiron" and Monel metal.

Moto Meter Co., Long Island City, N. Y.—Catalog 3. A catalog of the Motoco indicating thermometer, recently described in these columns.

Eclipse Fuel Engineering Co., Rockford, Ill.—Catalog describing the McKee Proportional Mixer for gas burners, an account of which appeared in these columns.

W. S. Rockwell Co., 50 Church St., New York City—Bulletin 260. A bulletin entitled "Spring Fever in the Forge Shop," which is concerned with methods of improving working conditions in shops so as to eliminate unbearable heat and gas conditions.

Weston Electrical Instrument Co., Newark, N. J.—Bulletin 1504. A bulletin giving specifications and description of the new Weston line of rectangular instruments.

Sullivan Machinery Co., 122 So. Michigan Ave., Chicago, Ill.—Bulletin 77-K. A bulletin giving specifications and description of Sullivan belt-driven air compressors.

Readers' Views and Comments

An Open Forum for Subscribers

The editors invite discussion of articles and editorials or other topics of interest

Patents to Government Employees

To the Editor of Chem. & Met.:

SIR—I have been greatly interested in the recent agitation by members of the United States Department of Agriculture for the opportunity to patent scientific discoveries made during the course of their research. Knowing the depressing financial situation under which most of the employees of the government labor, one can scarcely avoid giving them every support in their efforts.

However, we should not let our sympathies in the matter becloud the greater issue at stake. Legislation that is designed for the purpose of aiding federal employees may by its injury to business interests defeat the purpose for which it was planned and cause so great a change in the methods of government research work that business interests and scientific workers will become suspicious of each other's motives.

If Congress should approve of this proposed measure, we must not forget the difficulty that will confront those who must decide whether a patent is of value to the public, which paid for the research, or whether it may be given to a single concern. Who is able to foresee all the possibilities of a single invention? It may establish a monopoly, create new industries or affect the cost of production in many industries. Shall we create such a condition and place such responsibilities in the hands of men often swayed by political motives?

Another matter equally important is that of trade secrets in relation to government officials. At present many industries consult with government officials and often an entire commercial process is turned over to those who are working along similar lines in government laboratories, especially if advice is sought by the concern. Government men frequently have access to laboratories and plants of commercial concerns in addition to this consultation work. With the power to take out patents a man would certainly require considerable self-restraint to avoid taking advantage of what he learned and with a few additions of his own researches taking out a patent which might enrich him or a rival company. If this occurs, the usefulness of a government laboratory is at an end.

There are three classes of people that enter government service: first, those that are attracted by the opportunity to render service and wish to pursue scientific research; second, those that hope to gain an easy living and to live securely; third, those that enter primarily to gain experience and to fit themselves for industrial work. An able man, once his reputation is established, can easily enter industrial work if he desires to obtain financial reward commensurate with his services.

It is the first class that deserves our attention. In order to retain these men and to maintain a personnel of high character it would seem far better to raise their pay than to bestow the power to take out patents. Financial consideration is necessarily a factor but not the lure that draws men of this class into scientific fields. The opportunity to work in a chosen field and to disseminate the results of such work by publication with the hope, often fulfilled, that their discoveries may create industries or influence the economic and social life of the community is compensation for such men.

We know what scientific men need in terms of salary and equipment and opportunity. We know what conditions are necessary to produce the happiest and most productive atmosphere. Why, then, should we complicate the problem when its solution is so well known and the remedy so simple?

CHARLES N. FREY.

New York City.

Settlement of the Old Hickory Suit

To the Editor of Chem. & Met.:

SIR—I am astonished that your journal should be guilty of publishing an article so entirely incorrect and unjust as the account of the settlement of the Old Hickory case in your issue of March 3, 1924, p. 367. The incalculable injury of such misleading articles can never be adequately remedied, as the public rarely corrects its first impression. In these days reputations are apparently very lightly thought of, but it is seldom a paper of your standing is guilty of publishing such a misleading and incorrect report when the truth could so easily have been ascertained.

I wish to give you the following correct statement, which is substantiated by the decree filed in federal court at Nashville and a copy of which I inclose for your information.

Perhaps the most flagrant misstatement you make is the one in which you accuse E. C. Morse, former director of sales, of selling the property to himself, Davis and Phillips, and then assigning the contract to the Nashville Industrial Corporation. The facts are: That the Nashville Industrial Corporation made the highest bid and the property was sold to it direct. E. C. Morse was not then, and has not been since, in any way, shape, form or manner connected with the Nashville Industrial Corporation, as it did its business direct and in its own name. The people who were the stockholders in the corporation at the time of making the bid are the stockholders at present.

E. C. Morse, former director of sales of the War Department under the Wilson administration, disposed of nearly $1,000,000,000 worth of surplus property. Under the present administration I think he has been indicted in three cases, only one of which has been tried. This case, known as the harness case, was tried in West Virginia and the federal judge instructed the jury to bring in a verdict of not guilty. A reading of the judge's charge to the jury is an indictment of the government rather than of Mr. Morse.

E. M. Davis, of New York, is at present a stockholder. A. W. Phillips, who died soon after the indictment from troubles contracted while building the picric acid plant at Little Rock, Ark., for the government, was a stockholder in the corporation. The vindication of these men will come from a trial of the case.

As to the reported "recovery" of $1,700,000, which is grossly misleading, the following are the facts: Under the terms of the original contract the Nashville Industrial Corporation has always been from 3 to 5 years in advance of the stated required payments. The property was sold to it on Nov. 22, 1920, for $3,505,000, the corporation agreeing to furnish free storage for powder and other government property for 5 years. Up to Aug. 1, 1923, the date of filing the suit in equity, there had been paid to the government $1,999,110.87, leaving the balance on the purchase price of $1,505,889.13, over which there has never been a dispute between the government and the corporation. When the plant was turned over to the corporation, the government under the contract was allowed to ship a certain amount of material previously sold by them. The government claimed it had not shipped by $260,000 the amount agreed upon and the corporation claimed it had exceeded the amount.

The trial of the civil suit for abrogation of the contract on account of fraud was set for Feb. 11, 1924. Two weeks before this time a government representative called on our attorneys in Nashville and asked that we go to Washington, as he felt the case could be settled out of court. Our attorneys gave him our terms and told him on his return to Washington to consult with his principals and if our terms were satisfactory to let us know and we would come to Washington. A telegram was received and we entered into negotiations in Washington which resulted in our agreeing to allow their claim if they would allow certain ones of ours, which made a net difference of $194,110.87 to be added to the undisputed figure of $1,505,889.13, or a total of $1,700,000.

It was also agreed that the receivers' fee and the corporation's (but not the government's) court costs, amounting to $103.74, should be paid by the corporation on account of the government waiving the interest on the above balance during the litigation. The corporation was willing and offered to pay the entire balance of the purchase price if the government would move its property and deliver possession to that occupied by their storage. This could not be done by the War Department, so the terms stated were agreed upon, which provides a payment of $500,000 3 months after their free storage period expires. During this time we deposit

$250,000 in cash with the escrow agent, which is held by him and not paid to the government until the above date.

In order to bring the matters to a head we had many conferences with the War and Justice Departments in June, 1923, which resulted in our obtaining from them a stipulation that suit would be immediately entered and the case tried on its merits with no dilatory motions from either side. This suit was filed Aug. 1, 1923, and the writer and William P. Smith were appointed receivers. The case was dismissed Feb. 23, 1924, with the following words from the decree:

"It appears among other things, as well as from statements made by a counsel for plaintiff in open court, that there has never been any charge or claim of fraud or wrongdoing made by the plaintiff against any of the persons interested in or connected with the defendant Nashville Industrial Corporation or any other of the defendants and the contract involved herein and the execution thereof, except these against whom an indictment is now pending."

I trust you will appreciate the importance of giving this correction the same display you did the original article in order that you may in some measure compensate Mr. Morse, Mr. Davis and Mr. Phillips' family for the wrong you have done them. As for the corporation, when your readers have the facts, we are satisfied to have the administration given all the glory your readers are willing to accord them for the "recovery" (?).

I am not related to E. C. Morse and never met him until the time of the negotiations for the sale of this plant.

B. P. MORSE,
General Manager,
Nashville Industrial Corporation.

Physical and Chemical Properties of Refractory Materials

To the Editor of Chem. & Met.:

SIR—I was well pleased with the typographical appearance of my table on refractory materials you published recently. It was a difficult job and your typographers handled it very cleverly.

There were a few errors, however, due largely to the illegibility of my blue print. These are indicated below:

Property	Material	Should Read	Instead of
Coefficient of expansion	Porcelain	0.44×10^{-6}	0.44×10^{-6}
Specific heat	Silica (granular)	0.1867 (0 to 100°C.) 0.2640 (0 to 1100°C.) quarts (90)	0.1867–0.2640 (0–1100°C.) quarts (90)
		0.1882 (0–100°C) 0.2679 (0–1400°C.) cristobalite (90)	0.1882–0.2679 (0–1400°C.) cristobalite (90)
Specific heat	Graphite	0.254 (1380°C)	0.254 (138°C.)
Specific heat	Silica brick	25°–1200°C. 0.282	25–100°C. 0.282
True specific gravity	Silica (granular)	Quarts 2.65 Tridymite 2.27 Cristobalite 2.33 Amorphous 2.20 (93)	2.20–2.65 (93)
Resistance to acid fluxes	Graphite	e.g. CaF_2	e.g. Ca_fx
Coefficient of expansion	Chromite (bonded)	1.07×10^{-6} (0 to 1500°C) (88)	1.07×10^{-6} = 1500°C (88)

O. A. HOUGEN.

Madison, Wis.

Book Reviews

Romance and Business of Meat Packing

Two Noteworthy Contributions to the Literature on One of the World's Greatest Industries

THE AMERICAN LIVESTOCK AND MEAT INDUSTRY. By *Rudolf A. Clemen*, associate editor, *The National Provisioner*, formerly instructor in economics and history, Northwestern University. 872 pages, illustrated. Ronald Press Co., New York. Price, $6.

It is most surprising that the dramatic story of our greatest industry should have remained so long untold. True, fragments of it have been presented from time to time, but here for the first time is a comphensive account of the development of the great livestock and meat industry and a statement of its fundamental significance in the life of the nation. There is no industry of more intimate interest to the people as a whole. As essential foods, the products of the industry play an important part in the daily life of the nation, while one-sixth of the country's workers are directly employed in some phase of the business from livestock raising to meat retailing.

Even in colonial times, the curing, smoking and packing of meat were an important part of trade activity. With the shifting of the center of livestock raising to the Ohio Valley after the Revolution, small packing houses grew up, particularly in the vicinity of Cincinnati, which by 1840 had been called "Porkopolis." In those pre-refrigeration days the business was limited to hog products that could be readily cured or smoked. Until the railway began to reach out into the Middle West during the '50s, great droves of livestock were driven on foot from the beef belt over the mountains to Eastern markets. By the end of the Civil War conditions had so changed that the essential factors of the modern centralized cash market were present—stockyards (the Chicago Union Stock Yards having been opened Christmas Day, 1865), livestock commission firms and meat packing companies.

During 1870-1875 there developed, by one of the most remarkable coincidences in economic history, the four factors that made possible the present industry: a new source of livestock supply, the great cattle ranges of the Far West; extension of railroads west to the new sources; refrigeration; men to organize efficient distribution of livestock and meat, industrial builders such as Hammond, Morris, Armour, Swift and Kingan, whose biographies are stirring romances of American business.

With the refrigerator car began the dressed beef trade, although its establishment involved a bitter fight against public prejudice, the railroads and the local butchers. Federal inspection and the introduction of chemical control are economic benefits that grew out of the phenomenal expansion of the dressed beef business. The work of the chemist and chemical engineer in preventing waste through the utilization of by-products is a most fascinating story.

Four major problems still confront the industry. One of these, the actual physical operation of the packing business at a profit, is internal in character. The three others, of an external or public nature, are: the problem of marketing, the problem of labor and the question of monopoly.

This in brief is the story that is unfolded in Mr. Clemen's book, clothed in a wealth of detail and presented in most attractive style. Because of the vital part played by chemistry and chemical engineering, it is particularly inspiring to all members of these professions.

ALAN G. WIKOFF.

THE PACKING INDUSTRY. A series of lectures given under the joint auspices of the School of Commerce and Administration of the University of Chicago and the Institute of American Meat Packers. 357 pages, illustrated. University of Chicago Press, Chicago. Price, $3.

Another view of the packing business, as seen by experts within the industry, is presented in this volume. The lectures were delivered at the University of Chicago early in 1923 before the organization of the educational courses that developed later under the Institute of Meat Packing. Each lecture attempts to give in a few thousand words a survey of a broad subject. As each has been prepared by a leading authority, the series gives a most comprehensive picture of the packing business as a whole.

Following the general introductory lecture by Thomas E. Wilson on the development plan of the Institute of American Meat Packers are seven discussions of essential phases of the industry: Live Stock, the Basic Raw Material, by Henry C. Wallace; History and General Economics, by L. D. H. Weld; the Packing Plant and Its Equipment, by Arthur Cushman; Operations—Beef, Lamb and Byproducts, by Victor H. Munnecke; Pork Operations, by Oscar G. Mayer; Financing the Packing Industry, by E. A. Cudahy, Jr.; Science in the Packing Industry, by W. D. Richardson; Distribution of Meat Products, by F. Edson White.

This book forms a welcome addition to the literature of this mighty industry, a literature still in its infancy, but destined to grow to merited proportions under the stimulus of the men of vision associated with the industry. Books of this type will help to establish a better public appreciation of the packer's problems and may help to prevent a recurrence of some of the misunderstandings of the past.

ALAN G. WIKOFF.

A Handbook of Universal Utility

MECHANICAL ENGINEERS' HANDBOOK. *Lionel S. Marks*, editor-in-chief. Second edition, revised. 1,986 pages. McGraw-Hill Book Co., Inc., New York. Price, $6.

Handbooks for engineers vary widely both as to contents and method of presentation. Undoubtedly there is some table of contents that makes such a book of the widest possible use to engineers in the greatest number of industries. Also there is some one style of make-up that makes the information in a handbook most easily available.

When a handbook, as does the second edition of Marks' "Mechanical Engineers' Handbook," comes nearer to a realization of the optimum in both these qualities than have any of its predecessors, then it should be called a universal handbook for engineers. Such material as that presented on friction, heat, materials of engineering, machine elements, power, hoisting and conveying, building equipment, pumps, compressors, refrigeration and measuring instruments is fully as valuable to the chemical engineer as to the mechanical engineer. Of course, at bottom, all engineering is one, the different branches being really but the different applications of the same fundamental principles.

Here, then, is a book which, because of its contents and its indexing system, has long been recognized by engineers throughout industry as well nigh indispensable, brought up to date and expanded until it represents the most modern and authoritative compilation of useful engineering knowledge so far published. Among the new subjects treated, two in particular will interest the chemical engineer: drying, because the subject is of utmost importance in chemical industry and is here treated by a recognized authority, W. H. Carrier; and lubrication, because little is known of this subject and a source of dependable information has long been desired.

Before closing this little word of commendation for a truly great book, it is worth while to stress particularly the ingenious method adopted to shorten the work of looking up a reference. This system, used also in the first edition, is based on a division of the work into sections each treating of one topic and is in addition to a complete index. On the front and back inside covers and on the facing leaves are listed all the major topics to which one might wish to refer and opposite each is the number of the section in which the topic is treated. The book is indented at the first page of each section and the number of the section is shown in gold on a black tab. As an aid to the ready use of a reference volume, this system is priceless.

GRAHAM L. MONTGOMERY.

Industrial Relations

"Fifteen Roads to Good Will in Industrial Relations" is the title of a pamphlet which has been prepared by the Policyholders Service Bureau of the Metropolitan Life Insurance Co., New York. Throughout America business houses and industrial plants are being studied by experts to make them better places in which to work. Plans of all sorts are succeeding in increasing the happiness and welfare of the workers, and this study is an attempt to bring together the gist of all these activities under the following fifteen heads: Employment department, employees' handbook, wages, accident prevention, sanitation, house organs, mutual benefit associations, lunch rooms, physical examinations, vacations, group insurance, savings, pensions, education, recreation.

U. S. Patents Issued May 13, 1924

Centrifugal Pump. Don S. Willey, Chicago, Ill.—1,493,509.

Process of Making Articles of Hard-Rubber Dust. Claude E. Wing, Flushing, N. Y., assignor to American Hard Rubber Co., New York, N. Y.—1,493,511.

Centrifugal Contact Apparatus. Howard C. Freedenburg, Baltimore, Md., assignor to the Bartlett Hayward Co., Baltimore, Md.—1,493,525.

Method of and Apparatus for Treating Paper Stock. Anton J. Haug, Nashua, N. H., assignor to Improved Paper Machinery Co., Nashua, N. H.—1,493,535.

Method of and Apparatus for Removing Moisture From Paper Stock. Anton J. Haug, Nashua, N. H., assignor to Improved Paper Machinery Co., Nashua, N. H.—1,493,536-7.

Process and Means for Manufacturing Artificial Silk by the Stretching Spinning Method. Martin Holken, Jr., Barmen, Germany.—1,493,545.

These patents have been selected from the latest available issue of the *Official Gazette* of the United States Patent Office because they appear to have pertinent interest for *Chem. & Met.* readers. They will be studied later by *Chem. & Met.'s* staff, and those which, in our judgment, are most worthy will be published in abstract.

Complete specifications of any United States patent may be obtained by remitting 10c. to the Commissioner of Patents, Washington, D. C.

Azo Dyestuffs and Process of Making Same. Hermann Wagner, Hoechst-on-the-Main, Germany, assignor to Chemische Fabrik Griesheim-Electron, Frankfort-on-the-Main, Germany.—1,493,577.

Fiber-Separating Machine. Ernest D. Walen, Watertown, and Arthur H. Parsons, Gloucester, Mass.—1,493,578.

Gas Washer. Bruce Walter, Pittsburgh, Pa.—1,493,579.

Fluid-Measuring Apparatus. William A. Darrah, Chicago, Ill., assignor to Ekco Engineering Co., Chicago.—1,493,610.

Process of and Apparatus for Separating Air. Harvey N. Davis and Robert V. Kleinschmidt, Cambridge, Mass., assignors to Research Corporation, New York, N. Y.—1,493,611.

Process of Treating Saccharides. Chester C. Fowler, Chicago, Ill., assignor to National Candy Co., St. Louis, Mo.—1,493,623.

Grinder. David A. Harner and Julius N. Osterland, Cedar Falls, Ia.—1,493,630.

Liquid-Treating Apparatus. Inos B. Tanner, Chicago, Ill., assignor to Joseph E. Nelson & Sons, Chicago, Ill.—1,493,652.

Welding Apparatus. Edmund J. von Henke, Chicago, Ill.—1,493,656.

Artificial Fuel and Process of Making the Same. Henry C. Diers, Marshfield, Ore., assignor of one-fourth to George A. Martin, one-fourth to Earl W. McInturff, and one-fourth to William T. Stoll, all of Marshfield, Ore.—1,493,667-8.

Process of Evaporating Zinc Chloride. Ludwig Rosenstein, San Francisco, Calif., assignor to Great Western Electro Chemical Co., San Francisco.—1,493,705.

Water Glass and Its Process of Production. Louis Schneider, Barnard, N. Y.—1,493,708.

Water-Level Alarm. Nillo Oskar Holmsten and Sten R. Runtujarvi, Brooklyn, and Swend Lindquist, New York, N. Y.—1,493,751.

Method of and Means for Evaporation Below Ebullition Point. Harry E. La Bour, Chicago, Ill., assignor to Chemical Equipment Co., Chicago.—1,493,756.

Method of Treating Liquids. Harry E. La Bour, Chicago, Ill., assignor to Chemical Equipment Co., Chicago.—1,493,757.

Distillation Apparatus and Process. Ralph D. Lamie, Huntington, W. Va.—1,493,758.

Method of Drying Materials. Burt S. Harrison, Chicago, Ill., assignor to Carrier Engineering Corporation, Newark, N. J.—1,493,778.

Gas Cleaner. Benjamin J. Mullen, Ridley Park, Pa.—1,493,789.

Process of Manufacturing Arsenic Acid. Oswald C. Behse, Houston, Tex.—1,493,798.

Electric Furnace. Ora A. Colby, Irwin, Pa., assignor to Westinghouse Electric & Manufacturing Co.—1,493,842.

Process of Preparation of a Therapeutic Acting Colloid Soluble or Colloid-Like Divided Lime Combination. Eugene Donath, Bratislava, Czechoslovakia.—1,493,847.

Separation of Solids From Liquids. Max Kusch, Berlin-Friedenau, Germany.—1,493,861.

Manufacture of Liquid Fuel. Jacob Dolfen, Bern, Switzerland, assignor to Fritz Hostettler, Bern, Switzerland.—1,493,874.

Method of Producing Aluminum Formate. Richard Wolffenstein, Berline-Grunewald, Germany.—1,493,945.

Process of Refining Sugar From Refuse Molasses. Heber C. Cutler, Salt Lake City, Utah, assignor to United States Syrup Co.—1,493,967.

Process and Apparatus for the Recovery of Zinc. Heinrich Koppers, Essen-Ruhr, Germany, assignor to the Koppers Development Corporation, Pittsburgh, Pa.—1,493,993.

Process for Producing Hydrocyanic Acid and Alkali-Metal Nitrates. Otto Liebknecht, Frankfort-on-the-Main, Germany, assignor to Roessler & Hasslacher Chemical Co., New York, N. Y.—1,493,996.

Crucher. Charles S. Lincoln, Wauwatosa, Wis., assignor to Allis-Chalmers Manufacturing Co., Milwaukee, Wis.—1,493,998.

Method and Means for Converting Energy. Forrest Nagler, Wauwatosa, Wis., assignor to Allis-Chalmers Manufacturing Co., Milwaukee, Wis.—1,494,008.

Process of Separating the Constituents of Mineral Silicates. Sherman W. Scofield and John V. La Rue, Cleveland, O.; said La Rue assignor to said Scofield.—1,494,029.

Crusher. Francis J. Straub, New Kensington, Pa., assignor to Crozier-Straub, Inc., New York, N. Y.—1,494,036.

Resinous Composition. Emile De Stubner, New York, N. Y.—1,494,063.

Fatless Soap or Non-Fatty Detergent Products and System of Producing Same. Emanual Klein, New York, N. Y.—1,494,068.

Method of and Apparatus for Drying. Archibald P. Eright, East Orange, N. J., assignor to Industrial Dryer Corporation, Newark, N. J.—1,494,092.

Process of Separating Naphthol-Sulphonic Acids. Henry Berlin, Carneys Point, and Leon Adler, Penns Grove, N. J., assignors to E. I. du Pont de Nemours & Co., Wilmington, Del.—1,494,096.

Liquid Spray for Boll Weevils. Nelson Cox, Brinson, Ga., assignor to Cotton Industrial Corporation, Wilmington, Del.—1,494,101.

Filter. Jasper A. McCaskell, Salt Lake City, Utah.—1,494,122.

Electrically Heating Oil-Cracking Apparatus. Carl M. Page, Geneva, Ill., assignor to George Fabyan, Geneva, Ill.—1,494,125.

Process of Treating Petroleum and Petroleum Derivatives. Horace B. Setzer, Coffeyville, Kan., assignor to National Refining Co., Cleveland, O.—1,494,191.

News of the Industry

Summary of the Week

No action taken on helium bill in Congress and no likelihood exists for immediate legislation regarding adoption of metric system.

Senate Committee on Agriculture refuses to indorse Ford offer for Muscle Shoals. Hearings to close May 26.

French Government to establish a Forest Products Laboratory.

Reform sought in education along chemical lines by American Chemical Society.

Lime men at sixth annual convention find industry in a healthy condition.

Treasury Department has issued a revised list of standards of strengths of coal-tar dyes for purposes of customs appraisal.

Import duty on barium dioxide has been increased to 6c. per lb., under flexible provisions of the tariff act.

Imports of chemical products into Canada for the fiscal year ended March, 1924, were valued at $26,088,041.

Lime Men Find Healthy Condition in Industry

A marked increase in technical control of lime manufacture was pointed out last week at the annual meeting of the National Lime Association as being a development of major importance to the industry. The sixth annual meeting of the association, held at White Sulphur Springs, W. Va., from Tuesday, May 20, to Friday, May 23, was attended by 150. Inclement weather interfered with the program of sports including golf and baseball, but the technical sessions were held as scheduled and contained much material of general interest.

Research has been carried on with success during the past year under a co-operative program by which thirty men outside of the industry have been active in conducting studies of chemical lime. Quicksetting lime plasters and the properties and analysis of lime and lime products have been investigated. At Ohio State University the use of lime in treating trade wastes has received special attention under the direction of James R. Withrow. At the Massachusetts Institute of Technology the work has concerned itself to a considerable extent with the solubility of commercial limes, and as an outgrowth of the work several new uses have been opened up.

Under Professor Derling, at James Milliken University, the use of lime in textile work has been shown to be highly worth while. One new use that is developing for lime is the dusting or whitewashing of iron molds that are used for casting aluminum. Other advances include widened application of lime as a catalyst in manufacture of organic compounds. Acetone is being made from acetic acid, benzoic acid from benzyl chloride by the use of chemical lime. Mixtures containing lime with other metallic oxides are being used satisfactorily in the oxidation of ammonia.

At present indications point to an increase in the use of lime in the chemical industries during 1923 of 12 per cent over 1922. This may be caused in some measure, it is believed, by the notable influx of technically trained men into the industry. A development of general significance is the establishment of new and higher standards of quality.

W. H. McIntyre, of the University of Tennessee, reported facts and data in regard to reactions among lime, aluminum, iron, sulphur and silicon that may have a very important bearing on the chemistry of portland cement, lime and plasters of all kinds.

Nominations of officers for the coming year were made on Tuesday. George B. Wood, president of the Rockland & Rockford Lime Corporation, was nominated for re-election as president. The remaining officers also were renominated.

Research in the coming year will be continued on the same or a larger scale.

Higher Barium Dioxide Duty

A proclamation was issued by President Coolidge on May 19, increasing the duty on barium dioxide from 4c. per lb. to 6c. per lb. This was one of the chemicals which the Tariff Commission investigated and on which a report favoring an increase in duty was submitted to the President in the preceding week. It is the second chemical for which higher duties have been established under the flexible provisions of the tariff act and the maximum increase of 50 per cent was granted in each case.

Production of Calcium Arsenate Becomes More Stabilized

While the demand for calcium arsenate is expected to exceed the supply again this year, there are various indications that the manufacture of this important insecticide gradually is becoming more stabilized. One of the stabilizing factors is the fact that fully 50 per cent of the country's requirements are covered by contracts. In some instances contracts have been placed through farmers' co-operative organizations.

Ordinarily the spot demand develops earlier than May 15. On that date this year, however, the same sluggishness that has characterized the market since Jan. 1 still was in evidence. The government's specialists in Washington who are watching this situation expect a prompt change in this situation. As soon as spot buying becomes brisk, it is believed that production will increase rapidly. Stocks of raw material are larger than has been the case for several years and the manufacturers are in a position to maintain capacity production for a considerable period. Their stocks are not sufficient, however, to turn out all of the product that will be needed, but the early buyers are in a position to secure prompt deliveries on their orders.

To the expansion in the domestic production of white arsenic is being added a gradually mounting volume of imports. Japan's recent heavy shipments of white arsenic have come as a surprise. Exact information as to the source of the Japanese supplies is not at hand, but the knowledge that they are seeking contracts for a larger volume of arsenic than they are shipping at present is taken to indicate that they are in a position to furnish much more of this material than had been expected.

Forest Products Laboratory Founded in France

The Department of the Landes is the most important source of supply of resinous products in France. A new organization has been founded to develop the resources of this area of more than two and a half million acres by the extraction and treatment of resins, turpentine, and related products. This is in line with the great development in all chemical industries in France in an effort to free the country from dependence on foreign research.

The laboratory of the Institut du Pin, which will be located at Bordeaux, is the scientific organization that will endeavor to bring this about with respect to forest products. It is to be a highly scientific enterprise, treating, as it does, one of the less developed branches of industrial chemistry.

The various elements will comprise a research laboratory, an analytical laboratory, technical instruction to students, a center for information and propaganda and an industrial bureau.

The scope of the work projected is broad. Though situated in the region of the resinous pine, it proposes to treat of all chemical aspects of forest growth in France and the colonies such as do not come directly under the direct province of the Department of Forests. The range is from resin and turpentine to tar, wax, lamp black, insulating materials and various essential oils for the perfume and other industries, as well as such new applications as may be worked out for the manufacture of cellulose and paper pulp.

The new bureau is the outcome of a former laboratory instituted by Professor Vezes about 20 years ago and grows immediately out of the work of a national committee formed in 1921.

The discoveries of the Bureau des Recherches will not be made public, at least not before having been patented by those interested, thus forming a nationalized industrial clearing house, which may be drawn upon only for the benefit of France and the French.

British Rubber Plan Approved by Head of U. S. Company

Charles B. Segar, president of the U. S. Rubber Co., is on a vacation in California. Interviewed at San Francisco on May 8, he is reported to have concurred with existing regulations designed to stabilize the plantation rubber industry. Mr. Segar said, according to the San Francisco *Chronicle:*

"The British plan of regulating rubber production is working nicely for the benefit of the producer and manufacturer. The restriction on production under this plan is not endangering our supply, although the English and Dutch control about 90 per cent of the world's rubber output.

"The rubber market was in a fair way to ruin as the result of overproduction, until by the restrictive measure imposed by the British the price of rubber was again brought up. Also, under this system the plantation owner and the manufacturer are insured against loss in a market panic. We have a plantation of our own, but we depend almost entirely on British plantations for our raw material."

Senate Committee Refuses to Support Ford Offer

Activities of Proponents Fail to Win Favorable Action—Public Hearings Close May 26

By a vote of 10 to 6, the Senate Committee on Agriculture on May 21 refused to allow the bill embodying Henry Ford's offer for the Muscle Shoals properties of the government to go on the Senate calendar, even with an unfavorable report. No motion proposing to report the Ford bill favorably was made at this session of the committee. Had such a motion been made it probably would have been supported by not more than 4 votes. The objective of the proponents of the Ford bill at this hearing was to get the measure on the Senate calendar. They recognized that a favorable report could not be obtained, so the only motion made was that to report the bill unfavorably.

On failing to get the Ford bill out of committee, even with an unfavorable report, it then was moved to report Chairman Norris' government-control bill. This would have been of advantage to the Ford supporters, as the passage by the Senate of this substitute for the Ford bill would have thrown the legislation into conference. In this way many of the features of the Ford bill could be embodied in the conferees' bill. This proposal, however, was voted down 11 to 6. A motion to close the hearings immediately was lost overwhelmingly, but by a vote of 10 to 6 the committee agreed to close the public hearings on May 26 and to consider, in executive session, on the day following such final action as the committee may take.

The majority of the committee, it is believed, feels that in view of the government's $200,000,000 investment at Muscle Shoals the best course to pursue is government operation of the dam and its power house. In that connection it has been suggested that contracts for power, for a time at least, be for relatively short periods until actual operation may have demonstrated the terms and conditions under which the public's interest will be served best.

Senator Heflin of Alabama declares that he will find a way to secure a vote in the Senate on the Ford bill. He probably intends to propose it as a rider on some other bill.

C.E.A. Considers Exposition at New York Meeting

At a meeting of the Chemical Equipment Association held in New York May 20, President F. C. Oliver announced that plans are progressing favorably for the first chemical equipment exposition sponsored by this organization, which is to be held next year in Providence. Visitors are to be restricted to a technical and buying attendance, registered and paying no admission. Supplies, accessories, essential raw materials and equipment will be included in the exhibits.

A resolution was adopted at this meeting instructing the directors of the organization, composed of between forty and fifty companies, to incorporate the association under the laws of New York State.

Seek Reform of Education in Chemistry

National organization of chemical education, to aid in accomplishing broad plans of reform, is sought by the American Chemical Society, which, it is announced, is encouraging the formation throughout the country of state associations of chemistry teachers.

"It is essential," says Prof. Neil E. Gordon, of the University of Maryland, chairman of the society's committee on chemical education, "that teachers be able to meet frequently to improve their profession and thus promote the advancement of chemistry. Trial shows that these state associations, now existing in only a few states, have wrought the greatest good for chemistry, and hence the society's committee will further the establishment of similar organizations in each state or group of states.

The society's committee has two other objectives in carrying out its nationwide scheme of reform—national correlation of high school and college chemistry, and the organization of a national journal of chemical education. These three projects are being pursued simultaneously.

New Galvanizing Plant Soon to Open in Alabama

The Bessemer Galvanizing Works, Inc., Birmingham, Ala., is completing the erection of its new plant near the city limits, designed for an output of 800 tons per month, and purposes to place the works in service early in June. The plant will operate under the "hot dip" process, with equipment including an 80-ton capacity kettle for molten zinc; the machinery in all departments is of latest type and represents an investment of about $50,000. The company was organized recently as a subsidiary of the Nashville Bridge Co., Nashville, Tenn., but will operate as an independent unit. It is headed by A. J. Dryer, president of the last noted company, and H. L. Badham, head of the Bessemer Coal, Iron & Land Co.

Will Develop Sulphur Deposits of Java

Reports have reached the Bureau of Commerce to the effect that the government of the Netherlands East Indies is making some effort to have the sulphur deposits of Java worked, and recently issued a call for bids for the working of the Kawah Poetih deposits. Sulphur is obtained in various parts of Java, but up to the present time very little has been done toward working these deposits, due to the difficulties that will have to be overcome to make it a profitable venture.

Borings of the Kawah Poetih deposits were made in 1919 by order of the Netherlands Indian Government Mining Service, and it is reported that the quantity of sulphur-bearing deposits amounts to approximately 1,000,000 tons, one-half of which is 60 per cent pure sulphur, with an equal quantity of 20 per cent purity, or a total of 400,000 tons of pure sulphur. There are several other sulphur areas in Java, some of which are being worked at the present time.

Washington News

New Standards for Customs Appraisals of Dyes

A new and enlarged list of standards of strengths of coal-tar dyes for purposes of customs appraisal has been issued by the Treasury Department.

The list supplants that issued last August. The new list contains 469 standards, covering approximately 1,100 names of dyes, compared with 212 standards, covering about 600 names of dyes in the old list. The revised list represents a large number of tests made at the dye laboratory of the Customs Division in New York and data gathered from importers and domestic manufacturers of coal-tar dyes. It was submitted to large manufacturers and importers and consumers of dyes before being promulgated.

New features of the list are Schultz and Color Index numbers, where there are any, or letters indicating the method of application for each dye; a general index; and keys to the class index and manufacturers' names.

The list is issued in conformity with a proviso of paragraph 28 of the tariff act, which provides that the specific duty of 7c. per pound on finished coal-tar dyes shall be applied according to the strength of commercial imports prior to July 1, 1914, as most dyes now are imported in higher concentrations than before the World War. If a dye is imported now in double strength, the specific duty is multiplied by 2. The dyes listed as "standard" are merely chosen as of uniform commercial strength as imported prior to the 1914 date.

Importers have contended for months that the original list was too restricted to afford fair entry to the large diversity of dyes now coming in.

Decline in Sales of German Potash Salts

In a report from Consul O. N. Nielsen at Berlin, he states that the eight-month credit granted German domestic buyers of potash fertilizers from February 4 resulted in an increase of domestic sales of from 24,800 tons pure K_2O in January to 49,500 tons in February. However, these figures are far behind those for the corresponding months in 1922 and 1923. Domestic sales in January, 1923, totaled 62,950 tons; in February, 1923, 71,612 tons. Domestic sales in January, 1922, totaled 128,174 tons; in February, 1922, 63,117 tons.

Olive Oil Investigation Sought

R. U. Delapenha, representing the Olive Oil Association of America, has petitioned the Tariff Commission to make an investigation under section 316 of the tariff act pertaining to alleged unfair methods of importing olive oil from Italy but which originates in some other Mediterranean country. It is charged that the oil is shipped from its primary market to Italy and the unfair methods consist of reshipping such oil from Italy to this country bearing labels which proclaim it to be Italian oil. Under the provisions of the section the commission is empowered to make an investigation and conduct a hearing and if it finds sufficient evidence, the President may determine the rate of additional duty, not exceeding 50 per cent nor less than 10 per cent of the value of the articles involved, for the purpose of offsetting the alleged unfair method, and in extreme cases he can forbid importation.

Nitrate Restrictions May Not Be Enforced Against U. S. Firms

Representatives of W. R. Grace & Co. and the du Pont Co. in Chile, cable advices state, are convinced that no effort will be made to enforce against them the resolution restricting sales of nitrate of soda and nitrate lands recently adopted by the Nitrate Producers Association. Since neither one of the American producers is likely to be in the market for additional nitrate lands for a long time to come, the issue with regard to the sale of land will not be precipitated.

In this connection it is stated that the Guggenheim interests expect to enter the association if they acquire the properties for which negotiations now are in progress.

Import Duty on Copper Proposed

A duty of 6c. per pound on imports of copper is proposed in a bill introduced in the House by Representative James of Michigan. The bill takes the form of amendment to the existing tariff act. Mr. James says a duty on copper is necessary to conserve one of our important resources; to enable the producers to pay a living wage to their employees; to enable the owners of American copper mines to secure the return of a portion of their investment, and to protect the great American industry from ruin due to foreign competition.

Adulteration of Wood Oil

In a report on the adulteration of wood oil in China, Consul-General P. S. Heintzleman, of Hankow, says that a cheap grade of lubricating oil is used to a small extent for the purpose of adulterating wood oil in China. A prominent American oil company recently refused to supply a native dealer with this low-grade product upon being informed of its intended use. The favorite adulterants are cheaper vegetable oils, chiefly bean. It is not used as generally as heretofore, however, because of its advance in price. A method employed extensively last year was to mix vegetable and wood-oil seeds before pressing.

It is reported that oil arriving at Hankow from Szechuen and Hunan is good, but shipments from Loahokow (Hupeh) show some adulteration. In general, however, only small quantities of adulterated oil are arriving from the interior. The price of wood oil is lower than last year, and the Chinese dealers, who buy from the native presses and sell to the foreign firms, are now employing refractometers extensively and thereby are able to detect adulteration. Wood-oil exporting firms having testing laboratories are not likely to knowingly purchase adulterated oil.

Action on Cramton Bill May Be Deferred

Proponents of the Cramton bill proposing the establishment of a bureau of prohibition in the Treasury Department seem to have lost their enthusiasm for the measure. They do not like the amendment inserted by the committee in an effort to safeguard the legitimate uses of alcohol. The fanatical drys seem to think that even this concession to the users of industrial alcohol should not be granted. Other drys, less fanatical, see no objection to the committee amendment. Because of the division among the bill's advocates, it is believed that no serious effort will be made to secure consideration of the measure at this session.

Metric Legislation Not Pressed

Despite rumors to the contrary, no effort has been made to secure consideration of metric system legislation. Representative Vestal of Indiana, the chairman of the House Committee on Coinage, Weights and Measures, states that no single request for hearings on the metric bill has been made during this session of Congress. Mr. Vestal says that no hearings will be undertaken on his initiative, but he is willing to conduct them should members of the House favoring the legislation request such action. Chairman Vestal admits that he has not made a careful study of the reasons for and against the ultimate compulsory change to the metric system and does not propose to reach any personal conclusions as to the merit of the metric system bill until he has heard the arguments pro and con.

Larger Imports of Chemicals Into Canada

According to the report of the Dominion Bureau of Statistics, the value of all chemical products imported by Canada during the fiscal year ended March, 1924, was $26,088 041, an increase of $294,940 compared with the previous fiscal year. The value of the imports from the United States during this period was $18,419,795, a betterment of $4,800. The most outstanding increase in the Canadian imports was in drugs and medicines, the value of which was $2,655,544, the gain being approximately $400,000. Drugs and medicines purchased from the United States were valued at $1,198,433, an increase of $102,500. The greatest falling off was in dyeing and tanning products, the total of $3,787,341, representing a decrease of $266,789. Imports of dyeing and tanning products from the United States were valued at $2,611,299, a decrease of $203,900.

News in Brief

Brown Corporation to Make Byproducts—The Brown Corporation, Ltd., La Tuque, Que., which operates a 320-ton sulphate pulp mill, is planning enlargements which will enable it to manufacture a wide range of byproducts. At present the Brown Corporation is manufacturing turpentine. With the addition of further equipment it will be in a position to manufacture chloroform, industrial alcohol, bisulphite of carbonate, caustic soda and bicarbonate of soda.

A. S. M. E. to Discuss Metals—One of the feature sessions of the spring meeting of the American Society of Mechanical Engineers, being held in Cleveland, Ohio, May 26 to 29, will be a joint meeting with the American Society for Testing Materials on Thursday morning, May 29, on "The Effect of Temperature Upon the Properties of Metals." Interest in this session has been marked, and already more than a score of organizations have appointed official delegates to attend the meeting.

De Vains Plant Being Built—Arrangements have been completed between M. Dolphus, representing the De Vains interests of Great Britain, and a group of Winnipeg business men, including W. R. Allen, president of the Union Bank of Canada, for the construction of a plant for the manufacture of pulp from straw. The property on which the plant will be located is north of Selkirk, Man., and covers an area of 30 acres.

French to Make Mercury Boilers—Following in the steps of the American application of mercury vapor as replacing steam, a French company has just been organized to work the process in France. The company is known as the Société Hewittic, a fillial of the Hewettic Electric Co., Ltd. Capital is but 500,000 francs in shares of 500 francs each, of which 450 shares of the capital, rather less than half, in conformity with recent French law, are attributed to the British company. The Administrateur-Délegué of the French company is Albert Widmer, engineer of arts and manufactures at Paris.

Rutherford and Weston Honored—At a meeting of the Franklin Institute on May 21 the Franklin medal for scientific researches was awarded to Sir Ernest Rutherford, F.R.S., Cavendish professor of physics, Cambridge University, and to Dr. Edward Weston, president of the Weston Electric Co., of Newark, N. J. H. G. Chilton, counselor of the British Embassy at Washington, received the medal for Sir Ernest Rutherford and Dr. John S. Ames read a paper as his proxy on "Early Days in Radio-Activity."

Welded Pipe Made 210 Miles Long—Construction has been started on a 16-in. steel pipe line, 210 miles long, for carrying high-pressure natural gas from Shreveport, Louisiana, to Beaumont, Tex. It is being built by the Magnolia Gas Co. In many ways this line is considered an interesting piece of pipe work and is probably the biggest oxy-acetylene welding job ever undertaken. When the line is completed, in about 3 months, it will be a continuous tube of steel, 16 in. in diameter and 210 miles long.

New Chemistry Lab for Columbia—Columbia University has just announced a building program, to be put into effect at once, by which new buildings are to be provided for the departments of physics and of chemistry. The chemical laboratories are to be constructed at a cost of $875,000 and the new physics building with its equipment will cost $1,500,000. It is planned to make the new facilities available for students in the fall. No quarters are being added for the department of chemical engineering, although offices are to be established in the chemistry building.

Asbestos Paper Sizes Reduced—Under the auspices of the Division of Simplified Practice, a meeting of manufacturers and consumers was held in Washington last week and it was decided to eliminate seven sizes of asbestos paper in rolls, and two out of three sizes of asbestos mill board. It was also agreed to reduce weights of asbestos paper from eight to five, and thicknesses of asbestos mill board from seven to four.

Helium Bill Makes No Progress

No progress on the helium bill was made in the House during the past week. The application for a special rule, as this is written, is still pending before the Rules Committee. There is an element of chance as to whether or not an opportunity will be given for the House to consider this measure, but there is no reason to conclude that the rule will not be forthcoming.

The Senate Military Affairs Committee has requested certain amendments in connection with the leasing provisions of the bill, which have been perfected. A favorable report on the measure by that committee is assured.

Plans Being Pushed for Chemical Exposition in 1925

The National Exposition of Chemical Industries has five men in the chief markets of the world working to interest foreign buyers in American goods and also to induce as many consumers as possible to attend the 1925 exposition. This will be the decennial, and it is thought probable that the show will be the nucleus for a chemical industry demonstration in New York at that time. The exposition management reports a vigorous demand on the part of European manufacturers of chemicals, dyestuffs and apparatus for space in the show. It has not been stated how these foreign firms are to be handled.

Cement Concern Expands

The Southwestern Portland Cement Co., El Paso, Tex., operating a local mill, with second plant at Victorville, Calif., has decided to construct a third mill on site recently selected at Osborn, Ohio, about 10 miles from Dayton, and will proceed with grading and other preliminary work at once. The plant will comprise a number of operating units, with power house, and will be equipped to develop a maximum output of 6,000 bbl. per day, as compared with a capacity of 3,600 bbl. at the El Paso mill and 5,000 bbl. at the Victorville mill. It is estimated to cost close to $2,000,000 complete. The company has acquired a large tract of property adjoining the mill site for raw material supply. Carl Leonardt is president of the company, and O. J. Binford is secretary. The last noted will take up a residence at Dayton and represent the company in that district.

Seek New Uses for Slag

Betterment of present methods of utilizing the slag produced as a waste product of blast furnaces, and research looking toward the development of new methods of using it were discussed at a conference of the National Slag Association held at the Bureau of Standards recently. In addressing the conference, P. H. Bates, of the bureau, called attention to the fact that slag is now used in Europe for making "Eisen portland cement," which consists of about 35 per cent of ground slag and 65 per cent of portland cement. He expressed the opinion that such use would ultimately develop in this country. Eisen cement is nearly as strong as portland cement, he stated, and is also thought to be more resistant to attack by sea water and by alkali.

Following Mr. Bates, J. C. Pearson, chief of the bureau's cement section told the conference about tests made at the Bureau of Standards on the properties of concrete in which slag is used as aggregate. The bureau finds that if the usual proportions are adhered to the concrete made with slag is less workable than that made with gravel, and is not so easily handled, but this difficulty can be avoided by using a larger proportion of sand. Strength tests are now under way, and results are expected to be made public shortly. The slag concrete is found to fill about 6 or 7 per cent less space for the same volume of aggregates as compared with gravel concrete, Mr. Pearson stated.

There is 20,000,000 tons of slag produced annually in the United States, Mr. Pearson said, and it sells for a small fraction of a cent per pound. It is usually not handled by the steel industry, but is sold to independent concerns that make it into useful products.

The meeting was also addressed by Mr. McCullough, of the Chamber of Commerce of the United States, and R. M. Hudson of the Division of Simplified Practice of the Department of Commerce. Among the members of the association present were the president, C. L. McKenzie, president of the Duquesne Slag Products Co. of Pittsburgh, and the Secretary, H. J. Love of Cleveland, Ohio.

Trade Notes

J. J. LeClare has been placed in charge of the office of the Diamond Crystal Salt Co., which was recently opened in the Woolworth Bldg., New York City.

The production of bromine in Germany during 1923 amounted to 1,140 tons, increasing from 1,280 tons in 1922 and 460 tons in 1921. The larger figures for 1922 and 1923 are attributed, in part, to the greater consumption of the photographic industry.

George M. Young, Representative from North Dakota and a member of the Ways and Means Committee of the House, has been appointed a member of the Board of General Appraisers at New York.

A report to the Department of Commerce states that a match company operating plants at Cape Town and Durban has recently opened another factory at Cape Town. The company has entered into contracts for planting trees, to assure a supply of the necessary wood required, and 450 acres have already been planted in the Province of Natal, and a smaller area in the Cape Province.

John E. Edgerton, of the Lebanon Woolen Mills, was elected president of the National Association of Manufacturers at the twenty-ninth annual convention of that body, held last week at New York.

Joint rates on crude sulphur, in carloads, from New York City and Baltimore to Hamilton, Ont., are unreasonable, according to a decision of the Interstate Commerce Commission, upholding the complaint of the Grasseli Chemical Co. against the Baltimore & Ohio and other carriers.

Examination for Technologists

The United States Civil Service Commission announces the following open competitive examinations: Technologist, $3,800 to $5,000 a year; associate technologist, $3,000 to $3,600 a year; assistant technologist, $2,400 to $3,000 a year.

Applications will be rated as received until July 31. The examinations are to fill vacancies in the Bureau of Standards, Department of Commerce, at the entrance salaries stated above. Applicants must select one of the following optional subjects: Rubber technology, leather technology, paper technology, textile technology, oil technology, enameled metal technology, some special branch of technology not included in any of the above.

The duties of these positions comprise the application of scientific methods to industry; original investigations; development of processes and devices for the testing or treatment of materials; physical or chemical testing; and development of standards for rubber and related materials, leather and leather products, paper, textiles, lubricants and other viscous and plastic materials, enameled metal products, or other special or related experimental work. Competitors will not be required to report for examination at any place, but will be rated on general education and experience, special education and experience in the optional subject selected, fitness, and writings to be filed with the application.

Oil Pollution Bill Is Reported

The Rivers and Harbors Committee of the House of Representatives has reported favorably on the oil pollution bill introduced by Representative Wilson of Louisiana. This bill vests authority in the Secretary of War to prescribe such regulations as he may deem necessary to prevent the pollution of streams with oil. The recommendation of the committee practically insures the passage of the measure by the House unless this bill should be caught in the legislative jam that has developed. Prompt Senate action is expected if the bill should pass the House.

Japanese Dyestuff Situation

The Japanese production of dyestuffs was not undertaken to any great extent until after the outbreak of the World War in 1914 when supplies from Germany were cut off. With the growth of Japan's manufacture of silk, cotton, and woolen fabrics, the shortage was a serious matter and every effort was made to develop a dye industry in Japan which would make the country self-sufficient. The country's facilities for the manufacture of essential raw materials is evidenced by the following production statistics for some of the more important items in 1921:

Coal	26,220,000 tons
Sulphur	33,125 tons
Nitric acid	9,524,815 lb.
Acetic acid	5,381,515 lb.
Sulphuric acid	1,225,176,282 lb.
Caustic soda	24,420,721 lb.

There is a total of 19 dye factories in Japan, most of which are located in the Kansai District close to their markets in Osaka, Kobe, and Nagoya. The general facilities of the industry are shown by the following production statistics for the years 1921, and 1923. (Kin equals 1⅓ pounds.)

	1921 Kin	1923 Kin
Direct cotton dyes	299,871	474,781
Acid dyes	90,048	183,104
Basic dyes	350,195	199,866
Mordant dyes	128,544	10,241
Acid mordant	6,959	3,630
Vat dyes	72,909	2,377
Sulphur dyes	8,002,195	8,540,359
Miscellaneous	579,623	759,546
Total	9,530,344	10,173,904

The official statistics of dyestuff consumption in Japan are kept by the Department of Agriculture and Commerce, Tokyo, whose records were completely destroyed in the recent earthquake and fire. It has been estimated, however, that the annual Japanese consumption amounts to about 2,240,000 lb. of indigo, 4,000,000 lb. of other synthetic dyes, and 4,000,000 lb. of Japan-made synthetic dyes. Sulphur dyes constitute the bulk of the requirements and direct cotton dyes and vat dyes are probably consumed in quantities of over 1,000,000 lb. a year.

Financial

Stockholders of Swan & Finch have approved a reduction in the par value of the common stock from $100 to $25 and an increase in the authorized common stock from 40,000 to 160,000 shares and the issuance of two shares of new stock for each share of the old. Approval also has been given to a reduction of dividends on the preferred from 8 to 7 per cent a year and a change in the corporate name to Swan-Finch Oil Corporation.

At the annual meeting of the Anaconda Copper Mining Co., Percy A. Rockefeller, Nicholas F. Brady and Charles F. Brooker were re-elected to the board of directors.

The Federated Metals Corporation will be formed to take over 3 of the largest refiners and sellers of secondary metals in the country. The new concern will acquire the business and assets of the Great Western Smelting & Refining Co., of Chicago and San Francisco, the Duquesne Reduction Co., of Pittsburgh, and the non-ferrous metal business of B. Lissberger & Co., of New York. The latter company includes the Union Smelting & Refining Co., the Trenton Smelting & Refining Co. and the Eagle Smelting & Refining Works.

Latest Quotations on Industrial Stocks

	Month Ago	This Week
Air Reduction	70⅜	74⅜
Allied Chem. & Dye	68¾	71⅜
Allied Chem. & Dye pfd	113	115
Am. Ag. Chem.	8½	*8
Am. Ag. Chem. pfd	23½	24½
American Cyanamid	*94	*102
Am. Drug Synd	4⅞	4½
Am. Linseed Co	15½	16½
Am. Linseed pfd	*35	*33
Am. Smelting & Refining Co	60⅛	61⅞
Am. Smelting & Refining pfd	98	100
Archer-Daniels Mid. Co. w.i	21	20
Archer-Daniels Mid. Co. pfd	85	83½
Atlas Powder	*50	*50
Casein Co. of Am	*65	*66
Certain-Teed Products	*30	*28
Commercial Solvents "A"	50	50⅜
Corn Products (new)	35½	35⅜
Corn Products pfd	116⅜	119½
Davison Chem.	43¾	46½
Dow Chem. Co	*45	*45
Du Pon de Nemours	119¾	115½
Du Pont de Nemours db	86	87
Freeport-Texas Sulphur	8⅜	8½
Gold Dust	31	35⅜
Grasselli Chem.	*125	*125
Grasselli Chem. pfd	*102	*102
Hercules Powder	99	*95
Hercules Powder pfd	104	*102
Heyden Chem.	1⅛	1
Int'l Ag. Chem. Co. (new)	4	3⅛
Int'l Ag. Chem. pfd	5½	5
Int'l Nickel	12	11⅛
Int'l Nickel pfd	80	78
Int'l Salt	*88	*77
Mathieson Alkali	32½	30
Merck & Co	*65	64
National Lead	127⅜	130
National Lead pfd	*111	113
New Jersey Zinc	*140	*140
Parke, Davis & Co	*80	80
Pennsylvania Salt	*85	84
Procter & Gamble	*127	*127
Sherwin-Williams	30⅛	29⅛
Sherwin-Williams pfd	103	100⅜
Tenn. Copper & Chem	7	7
Texas Gulf Sulphur	57⅜	60⅛
Union Carbide	57	56⅜
United Drug	75	71⅛
United Dyewood	*40	*38⅜
U. S. Industrial Alcohol	65⅛	63
U. S. Industrial Alcohol pfd	100⅛	*100
Va.-Car. Chem. Co	2	1⅛
Va.-Car. Chem. pfd	6⅞	5⅜

*Nominal. Other quotations based on last sale.

Men You Should Know About

Dr. WILLIAM CROWELL BRAY, associate professor of chemistry at the University of California, has been elected to membership in the National Academy of Sciences. Dr. Bray was associate director of the Fixed Nitrogen Research Laboratory during 1919 and has specialized in the problems connected with the internal structure of the atom.

B. T. BUSH, of Burton T. Bush, Inc., is now president of the Synthetic Organic Chemical Manufacturers Association.

Dr. GEORGE L. CLARK, formerly of the University of Chicago and Vanderbilt University and more recently a National Research Fellow at Harvard University, has joined the staff of the Research Laboratory of Applied Chemistry, at the Massachusetts Institute of Technology, Cambridge, Mass.

GALEN H. CLEVENGER was at the zinc smelters in the natural gas fields of Kansas, Oklahoma, Texas and Arkansas during the month of April.

M. L. CROSBY of the Calco Chemical Co., Bound Brook, N. J., has been elected president of the American Institute of Chemists.

W. M. CORSE, of the National Research Council, Washington, D. C., has accepted an invitation to deliver the Third Annual Autumn Lecture before the British Institute of Metals in London, England, on the evening of Sept. 8.

HALSEY DURAND, of Newark, N. J., has been appointed temporarily as city chemist to succeed HERBERT BALDWIN, retired.

E. H. FOLLWELL, formerly in the operating department of the Cincinnati Chemical Works, Inc., Cincinnati, Ohio, is now in the engineering department of the Solvay Process Co., Detroit, Mich.

V. L. HAVENS, formerly editor of *Ingeniería Internacional*, published by the McGraw-Hill Co., Inc., is now engineer for the treasurer's department of the Equitable Life Assurance Society of the United States, New York.

Dr. ELLWOOD HENDRICK has been appointed honorary curator of the Chandler Museum, Columbia University, New York.

Major HARRY S. KIMBERLY, formerly of the Chemical Warfare Service, has organized the Washington Commercial and Research Service, with offices at 1701 H St., Washington, D. C., to give manufacturers in the dye, chemical and related industries a personal representative in the national capital. The new organization, it is announced, purposes to keep manufacturers in these industries informed on the many things affecting their interests that are happening in government departments, including research, and in Congress. The service will also act as the personal representative of the manufacturers in any ordinary matter they may want taken up with any branch of the government.

P. E. LANDOLT, assistant to the president of the Research Corporation, has resigned to become Eastern representative of the Western Precipitation Co. and International Precipitation Co., of Los Angeles, Calif., with headquarters at 25 West 43rd St., New York City.

C. O. MILLER has been appointed curator at the University of Chicago, to succeed Dr. H. B. SIEMS, who recently resigned to go into industrial work.

Dr. R. B. MOORE, who has been appointed general manager of the Dorr Co., as mentioned in *Chem. & Met.* May 19, is to be head of the development department.

JOHN T. ORR has severed his connection with the Air Reduction Co. and is now with the J. D. Crosby Co., Pawtucket, R. I.

R. L. PEELER, of Los Angeles, Calif., has been elected president of the California Petroleum Corporation, to succeed I. W. FUQUA, who resigned on account of ill health. Mr. Peeler will also act in the same capacity for the Petroleum Midway Co., a subsidiary. Heretofore he has been vice-president, in charge of lands and leases.

W. M. PRIDDY has been elected president of the American Refining Co., Wichita Falls, Tex.

E. F. REHKLAU, of Adrian, Mich., has severed his connection as chemical engineer with the Amendt Mill Co., Monroe, Mich.

CHARLES B. SEGER, chairman and president of the United States Rubber Co., New York, is touring the Pacific Coast and other Western points on a vacation trip.

E. C. SMITH, chief metallurgist of the Central Steel Co., Massillon, Ohio, spoke before the Washington Chapter of the American Society for Steel Treating, May 16, on "Open-Hearth Alloy Steel Practice."

Calendar

AMERICAN ASSOCIATION OF CEREAL CHEMISTS, Curtis Hotel, Minneapolis, Minn., June 9 to 14.

AMERICAN CERAMIC SOCIETY, summer meeting and tour, July 21 to Aug. 18.

AMERICAN ENGINEERING STANDARDS COMMITTEE, executive meeting, New York, July 12.

AMERICAN INSTITUTE OF CHEMICAL ENGINEERS, Denver, Colo., July 15 to 18.

AMERICAN LEATHER CHEMISTS ASSOCIATION, Spring Lake, N. J., June 18 to 20.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS, Cleveland, Ohio, May 26 to 29.

AMERICAN SOCIETY FOR TESTING MATERIALS, Atlantic City, June 23 to 28.

CANADIAN INSTITUTE OF CHEMISTS, Queens University, Kingston, Ont., May 27 to 29.

MANUFACTURING CHEMISTS ASSOCIATION, annual meeting, India House, New York City, June 4.

NATIONAL FERTILIZER ASSOCIATION, Kenilworth Inn, Asheville, N. C., June 9 to 14.

NEW JERSEY CLAY WORKERS ASSOCIATION AND EASTERN SECTION AMERICAN CERAMIC SOCIETY, summer meeting, Trenton, N. J., June 20.

SOCIETY FOR PROMOTION OF ENGINEERING EDUCATION, Boulder, Colo., June 25 to 28.

WORLD POWER CONFERENCE, London, June 30 to July 12.

R. E. WILSON, director of research for the Standard Oil Co. of Indiana, gave an address at a recent meeting of the state section of the American Chemical Society, at Indianapolis, dealing with the "Corrosion of Iron and Steel."

ROY M. WOLVIN, president of the British Empire Steel Corporation, Ltd., has left New York for England on a short business trip.

R. O. WOOD, formerly with the Grasselli Chemical Co., is now connected with the New York Edison Co.

At a meeting of the Indiana Section of the American Chemical Society at Indianapolis, May 9, the following officers were elected for the coming year: I. L. MILLER, state food and drug inspector, president; C. K. CALVERT, assistant engineer for the board of sanitary commissioners, vice-president; and H. A. SHONLE, secretary. The new executive committee is composed of JOHN H. WALDO, JOHN C. SIEGESMUND and D. R. MAY.

Obituary

FRANK C. CALDWELL, a director of the Link-Belt Co. since the purchase of the H. W. Caldwell & Son Co. by the Link-Belt Co. in 1921, was stricken with heart failure the morning of May 15 while on the way to his bank. He died in an ambulance en route to a hospital.

PATRICK J. LYNCH, a member of the firm of Lynch Brothers, Boston, Mass., manufacturers of morocco leather, with tannery at Salem, died on May 11 at his home at Beverly, Mass., aged 69 years. He was prominent in civic affairs in the section where he resided, and is survived by three brothers and one sister.

African Alkali Plant Closed

William E. Vaughn, Jr., secretary to the Trade Commissioner at Johannesburg, has forwarded a report in which he states that the South African Alkali, Ltd., which operated at the Pretoria saltpan, ceased production at the beginning of March. The directors state that this was caused by the dumping of carbonate of soda from overseas, and by the failure of the government, notwithstanding repeated representations over a period of 16 months, to grant the industry any measure of protection in the matter of dumping and customs duties. Quite recently some extensions were made to the factory, at which time the future prospects of the company were very promising.

The Rand mines' consumption of soda averages between 500 and 600 tons per annum and during 1923 nearly £20,000 worth of carbonate of soda was imported into the Union of South Africa. Caustic soda to the amount of £100,000 per annum is imported into the Union. Salt and soda in solution was recovered from the saltpan at Pretoria without difficulty, having been pumped up through the boreholes and accumulated in a reservoir of 40,000 gal. capacity.

Market Conditions

Quiet Conditions Prevail in Market for Chemical Products

Some Consuming Trades Report Further Curtailment of Operations During Past Week—Price Tendency Still Downward

REPORTS from the textile trade last week indicated that manufacturing operations had been cut down and in some cases had been entirely suspended. The paint and varnish trade also is feeling a seasonal reaction and with buying power in various lines reduced, the effect is noticeable in a lessened trading movement in the market for chemicals and allied materials. Sellers generally report a spotted market with fair inquiry for some staples and specialties and a lack of interest in others. Withdrawals of heavy chemicals on contracts have declined in volume and there are reports of consuming trades reselling materials purchased on contract.

Price changes for the period were not important but the tendency is still in buyers' favor and the weighted index number rested at 151.26 as compared with 151.37 for the preceding week. It is noted that some important materials show a tendency to decline, although no actual reductions have been announced. This leads to the belief that further revisions may be expected before the movement of prices turns toward higher levels.

Results of tariff investigations have begun to assume importance in the market. This was exemplified first in an increase of 1½c. per lb. in the duty on imports of nitrite of soda. Last week a proclamation by the President placed the duty on barium dioxide at 6c. per lb., replacing the former duty of 4c. per lb. Further results along these lines are awaited and predictions are heard that tariff changes in other chemicals will be made in the near future.

There is still some uncertainty about the workings of the resolution recently passed by the Chilean Nitrate Producers Association but the two American companies which are most directly concerned appear to have full confidence that the new legislation will have no bearing on their business transactions either here or in Chile.

Export and import trade in chemicals is below the more active standards which prevailed last year but many chemicals of foreign origin are prominent in domestic markets and the outward movement reaches a fairly large total.

Acids

Domestic producers of tartaric acid are still quoting 30c. per lb. but prices for imported offerings are more favorable and the preference is given to them. Asking prices for imported range from 27c. to 28c. per lb. according to make and seller. The fact that foreign-made tartaric has been underselling the home product for some months has had the effect of cutting down home production. In some cases firms that were producing in this country last year have discontinued these operations and are handling only the imported product. Oxalic acid fails to hold a steady price position. One producer is reported to have suspended operations but continues to sell from surplus stocks and there is no lessening in competition among sellers. Prices are largely a matter of negotiation with sales reported at 9¼c. per lb. and asking prices generally are at 10c. to 10¼c. per lb. Citric acid is moving in a fairly normal way with imported grades underselling domestic. Mineral acids have not varied much and conditions remain favorable to buyers as stocks of most selections are large.

Methyl Acetone Lower—More Interest in Arsenic—Caustic Soda Easy—Bichromates Are Reduced in Price—Prussiate of Soda Irregular—Permanganate of Potash Firm—Sal Ammoniac Eases Off—Oxalic Acid Under Pressure

Potashes

Bichromate of Potash—Sellers have been openly quoting 9¼c. per lb. and as this figure was named by first hands it may be taken as representing the trading basis. However, there are first hands who are quoting 9¼c. per lb. and prices, therefore, vary according to seller.

Caustic Potash—Arrivals of caustic potash from abroad were noted during the interval. The increase in spot offerings gave an easier tone to values and 6¾c. per lb. became more of a general quotation. In some quarters 6¾c. per lb. was held as an inside selling price but buying orders were limited and there were few who were interested at the 6¾c. price. Shipments from abroad were about on the same level as spot goods.

Permanganate of Potash—There were reports current that imported permanganate was offered at 14c. per lb. However, buyers were in the market at that figure and were unable to place orders. Actual inquiries for specific amounts brought out offerings at 14¼c. per lb. with up to 15c. per lb. quoted in certain directions. Domestic permanganate was offered at 14¼c. per lb. at works. Shipment prices for imported selections are said to be too high to make 14c. per lb. offerings possible in the spot market and values seem to be well maintained at the higher levels.

Prussiate of Potash—Sales of red prussiate of potash were reported at 38c. per lb. and while the quotation was given at 35@38c. per lb., the inside figure was not free. Yellow prussiate was quiet but sellers of imported material continue to ask 18½c. per lb. and upward and there is no sign of weakness in the market.

Sodas

Bichromate of Soda — While there have been attempts to hold production down to a level closely approximating consumption, it is becoming evident that there are accumulations. The appearance of resale lots has offered competition to producers and some first hands have reduced their asking prices to 7¼c. per lb. The latter figure is being met in most quarters and practically represents the trading basis, though quotations of 7½c. per lb. are still heard. Demand is not expected to gain much headway in the next 3 months. Chrome ore is quoted at $19@$22 per ton, c.i.f. Atlantic ports.

Caustic Soda — The tone to prices was less firm last week. This was due to reports that some producers were trying to reduce holdings and were willing to sell below the levels openly quoted. It was rumored that a round lot was offered for export at 2.75c. per lb., f.a.s. New York. Asking prices for export shipments generally were held at 2.90@3.05c. per lb., f.a.s., and at least one sale went through at 2.90c. per lb. Buying on the part of home consumers was quiet and call for contract deliveries was said to have slowed up. No change in prices has taken place but feeling is quite bearish. Details for exports in March show that Cuba was the largest buyer, taking 1,165,784 lb. Then came Mexico, 796,799 lb., Brazil, 781,628 lb., Canada, 623,734 lb., Philippine Islands, 588,950 lb., Japan, 522,200 lb., China, 422,120 lb., and the balance scattered in small amounts over numerous countries.

Fluoride of Soda—A fair call for supplies is reported with small lots predominating in sales. Prices are arranged on a quantity basis with 8¾@9c. per lb. quoted for round lots and up to 10c. per lb. for small amounts.

Nitrate of Soda—Reports from primary markets state that the Chilean

producers have called for bids based on the recently announced price schedule. It is also stated that the amounts to be sold have been specified with the allotments for nearby months placed at 200,000 tons monthly. It is unofficially stated that the restriction on sales to firms outside the association will not cut down the amounts available for shipment to this country. The regulation limiting sales of nitrate lands to members of the association will prevent American companies from adding to their holdings but this is not giving any concern. The market for spot nitrate is in a firm position with offerings limited. Prices for spot goods are given at $2.60 per 100 lb. but this figure is largely nominal in view of the lack of supplies. Similar conditions are reported in leading markets in the southern states.

Nitrite of Soda—The firmness which has distinguished this chemical recently, is still in evidence. Domestic producers are able to offer but sparingly and stocks of imported are not large. Prices heard range from 8¾c. to 8½c. per lb. Demand is slow as most consumers are covered ahead and interest is centered largely on the future activities of domestic producers and the effect of the higher duty on landed prices for imported grades.

Prussiate of Soda—Domestic grades were said to have been offered direct to consumers at 9½c. per lb. Imported grades were not attracting much attention and were quoted at 9¾@10c. per lb., according to seller.

Miscellaneous Chemicals

Arsenic—There were more signs of activity in the market. Interest was aroused by the presence of low priced offerings and sales went through early in the week at 8c. per lb. Later the market steadied and bids at 8c. and even 8¼c. per lb. went unfilled. Some reports stated that trading factors were willing to absorb cheap lots and other reports held that inquiry was coming from consumers. Toward the close of the week, the asking price for foreign arsenic of European origin was 8⅝c. per lb. and Japanese stocks were held at 8½c. per lb. Calcium arsenate was dull and easy in tone with quotations at 10½@11c. per lb., for carlots, at works.

Bleaching Powder—New business has continued along quiet lines and call for contract deliveries is said to have been less prompt than earlier in the year. The price tone is easy with offerings reported by second hands under the quotations of producers. The latter have made no change in their price schedule and quote large drums at $1.90 per 100 lb., carlots, at works.

Copper Sulphate — Imported grades of sulphate have eased off and scattered holdings in the spot market were offered at 4¼c. per lb. The price range was 4¼@4⅜c. per lb. Shipments from foreign points also were more in buyers' favor and 4¼c. per lb. could be done. Domestic sulphate varies in price according to seller with 4.65@4.80c. per lb. asked.

Formaldehyde—Offerings continue in large volume and with competition among sellers keen the tone to prices is easy. The lowest price openly quoted is 9¾c. per lb., for carlots, but it is stated that this can be shaded on firm business. Some sellers are observing a strict price differential according to quantity and demand premiums for less carlot amounts.

Methyl Acetone—This material has been under some selling pressure and asking prices have been reduced. In some quarters tank cars have been quoted at 75c. per lb., but there are reports that 70c. per gal. has been done. Acetone is quiet but the price of sellers is given at 15@16c. per lb.

Sal Ammoniac — With consuming trades showing very little interest, values for imported white sal ammoniac have eased off. Holders of spot material were willing to accept 6¼c. per lb. and were offering forward positions at 6¼c. per lb.

Salt Cake—Conditions favor buyers as far as spot and prompt shipments are concerned. These positions are available at $18 per ton, but contract prices are given at $20 to $23 per ton, according to seller.

Alcohol

Stocks of denatured alcohol are not burdensome and, so far as leading makers are concerned, the market remains in a fairly steady position. The fact that some resale parcels sold at concessions had no influence on the general situation. Prices held on the basis of 45½c. per gal. for the No. 1 special, drums, carload lots. There was no change in butyl alcohol.

Methanol was quotably unchanged. The undertone was easy, the recent decline having stimulated business to a limited extent only. The 95 per cent grade was offered freely at 80c. per gal., in bbl., carload lots, and 75c. per gal., in drums.

"Chem. & Met." Weighted Index of Chemical Prices

Base = 100 for 1913-14

This week	151.26
Last week	151.37
May, 1923	178.00
May, 1922	159.00
May, 1921	143.00
May, 1920	279.00
May, 1919	227.00
May, 1918	267.00

The moderate decline in the weighted index number reflects lower prices for glycerine, arsenic and copper sulphate.

Coal-Tar Products

Phenol for Prompt Shipment Firmer—Benzene Steady on Restricted Production—Refined Naphthalene Unsettled

THERE was some buying interest in phenol for prompt shipment. Buyers learned that offerings of U.S.P. material for May-June delivery were small and the inquiry steadied prices in all quarters. Scattered lots sold at 28c. per lb., with few sellers at this price at the close. The forward position, however, underwent little change, supplies being available for July shipment at the old price. Refined naphthalene was unsettled on liberal offerings and odd lots sold at concessions. Cresylic acid prices varied, competition resulting in sales of even small lots at inside quotations. Pyridine on spot was in scanty supply and rather firm, although demand continues quiet. Aniline oil sold at unchanged prices. Production of byproduct coke has been decreased again and this tends to support the market for benzene, solvent naphtha and toluene. Advices from Washington report that a new and enlarged list of standards of strength of coal-tar dyes has been issued by the Treasury Department for purposes of customs appraisal.

Aniline Oil and Salt—The market was described as steady, producers reporting business at the former price of 16c. per lb., carload basis, drums extra. Aniline oil for red was nominal at 40c. per lb. Aniline salt held at 22@23c. per lb.

Alpha-Naphthylamine—Producers reported a quiet trade in this intermediate, but maintained the selling schedule at 35c. per lb., round-lot basis.

Benzene—With production curtailed the market for all grades of benzene closed with prices steady. Demand has been less active, but sufficient to move stocks. Leading producers quote 23c. per gal. on the 90 per cent grade and 25c. per gal. on the pure, tank car basis, works. Exports of benzene for the 9 months ended March 31 amounted to 72,651,456 lb., which compares with 48,390,591 lb. for the corresponding period a year ago.

Cresylic Acid—Offerings came out at rather easy prices. Demand was fair, but stocks were large and selling pressure was in evidence. On the 95 per cent grade prices ranged from 60@65c., with the 97 per cent grade at 65@70c. per gal.

Naphthalene — There was no improvement in the general situation. Offerings of refined flake were liberal enough to cause selling pressure and prices at the close were more or less nominal at 5@5¼c. per lb. The inside price has been shaded in the past week or so. Chipped material was nominal at 4¼@4⅜c. per lb. Crude, to import, good quality, settled at 2@2¼c. per lb., c.i.f. New York. Demand for crude quiet.

Phenol—U.S.P. material on spot sold at 28c. per lb., in drums, indicating that sellers' views remain firm. Offerings of nearby phenol were scanty and a fair buying interest soon absorbed most of the supplies. There were sellers of July forward at 26c. per lb., in drums, but consumers held off from placing contracts.

Pyridine — Spot stocks extremely small and market wholly nominal. With replacement costs up prices held around $5.25@$5.50 per gal.

Vegetable Oils and Fats

Cottonseed Oil Easy on Weakness in Lard—Linseed Unsettled—Coconut Oil and Tallow Lower

THE undertone in the market for vegetable oils was easy. Offerings of Ceylon type coconut oil were more numerous and before the close round lots changed hands for forward delivery at lower prices. Soap makers were buyers of tallow at concessions. Weakness in lard offset the favorable April statistics on cottonseed products and the market for cottonseed oil was rather heavy. Refined rapeseed oil on spot was lower. Crude corn oil was easy. Spot prices for olive oil foots were below the cost of import. Palm oils were inactive and featureless. China wood oil was irregular.

Cottonseed Oil — The movement of refined oil into consumption during April, according to an analysis of the Bureau of the Census statistics, approximated 187,500 bbl., which compares with 148,000 bbl. a year ago. The showing was considered favorable. The visible supply of refined oil on April 30, converting stocks of seed and crude oil into the refined product, amounted to 797,000 bbl., which compares with 948,000 bbl. a month ago and 719,000 bbl. a year ago. It is estimated that 70,000 bbl. will come to hand over the remainder of the season, making the total supply in sight 867,000 bbl. As new oil may not be available in quantity before November the supply of old crop oil provides for only 144,500 bbl. for monthly distribution for the May-Oct. period. Actual consumption of refined oil for the 6 months ended Oct. 31 last year was at the rate of 170,000 bbl. monthly. In spite of what appears to be a rather strong statistical situation in old crop oil traders believe that the action of lard will have a decided influence on the future course of the market. Demand for cash oil and lard compound in the past week was fair, shading of prices inducing business. Lard compound was lowered to 11½c. per lb. so as to meet competition with pure lard. Pure lard was offered in the New York market at prices ranging from 10½@11c. per lb., the top figure obtaining on prime Western. Crude cottonseed oil closed at 7⅞c. bid and 8c. asked, tank cars, f.o.b. mills, Southeast and Valley.

Linseed Oil—The Northwestern seed markets were 8c. per bu. lower. New business in oil has not been good and this has checked the call for seed and brought out a slightly easier undertone. Spot and nearby oil sold at 94c. per gal., carload lots, cooperage basis, New York territory, indicating that prices covering May-June delivery did not change. But offerings of July forward increased, one crusher taking on business at 90c. for July delivery, a decline of 2c. from the inside price named a week ago. Other crushers continued to quote 92c. on July deliveries, but admitted that the undertone appears to favor buyers. Some resale oil sold for June delivery at slight concessions. Planting is still in progress in the flaxseed belt and reports of the new crop outlook continue favorable. In sections where the plant is showing above ground a good stand is reported. The Duluth market for May seed closed at $2.43 per bu., with Sept. at $2.13½ per bu. The recent decline in the domestic market had little affect on sellers in the Argentine, the June option at Buenos Aires holding around $1.61½ per bu. Exports of flaxseed from the Argentine from Jan. 1 to May 16 amounted to 32,162,000 bu., which compares with 30,280,000 bu. for the corresponding period a year ago. Linseed cake for export was quiet, with prices nominal at $33@$34 per ton, f.a.s. New York.

Cottonseed Oil Distribution in *April 187,500 Bbl.*

Disappearance of refined cottonseed oil in April amounted to 187,500 bbl., which compares with 162,100 bbl. in March and 148,000 bbl. in April a year ago. The April distribution of oil was larger than anticipated. Cottonseed statistics for the 9 months of the crop year ended April 30, with a comparison, follow:

	August-April 1923–24	August-April 1922–23
Seed received, ton	3,248,501	3,183,211
Seed crushed, ton	3,122,888	3,130,219
Crude oil mfd., lb.	921,698,715	962,181,590
Ref'd oil mfd., lb.	748,018,357	835,584,067
Stocks April 30:		
Seed, ton	130,953	61,529
Crude oil, lb.	73,111,861	36,962,220
Ref'd oil, lb.	216,427,193	237,216,179
Exports, 9 months:		
Crude oil, lb.	22,049,413	24,643,522
Refined oil, lb.	11,735,503	33,715,722
Cake and meal, tons	102,961	215,491

Corn Oil—Crude corn oil sold in the West at 8@8½c. per lb., tank cars, f.o.b. point of production.

Coconut Oil—Good buying took place at a decline of ¼@⅜c. per lb. in price. One lot of 30 tank cars of Ceylon type oil sold for Dec.-Mar. shipment at 8c. per lb., tank car basis, New York. A parcel of 2,000 tons of Manila oil sold for summer shipment from the Philippines at 7.70c. per lb., bulk basis, c.i.f. New York. Another lot, quantity not specified, sold at 7½c. per lb., bulk basis, c.i.f. Pacific coast ports. Bids were in the market toward the close at 7⅝c. per lb., Manila or domestic Ceylon type oil, tank car basis, July-Dec. delivery, Pacific coast shipping centers. Manila sundried copra closed nominally at 4⅞@5c. per lb., c.i.f. coast.

China Wood Oil—Sales took place on the basis of 14¼c. per lb., in bbl., carload lots, New York. Tank cars for May-June-July shipment from the Pacific coast were offered at 12⅝@12¾c. per lb. Demand moderate and market irregular.

Soya Bean Oil—Bulk oil was offered at 7c. per lb., in bond, c.i.f. Pacific coast ports, May-June shipment from the Orient. For nearby oil in sellers' tank cars 9¾c. asked, duty paid, Pacific coast.

Palm Oils—Niger oil for shipment offered at 6.60c. per lb., c.i.f. New York, but buying interest limited because of weakness in tallow. Lagos oil on spot held at 7⅜@7½c. with sales of futures at 7.05c. per lb., c.i.f.

Olive Oil Foots — Selling pressure again in evidence on spot and prices nominal at 9@9¾c. per lb.

Tallow, Etc.—Several round lots of extra special tallow sold to soap makers on the basis of 7c. per lb., f.o.b. point of production, a decline of ⅛c. for the week. Choice yellow grease, 10 per cent acid, held at 6¾c. per lb., with dark high acid material nominal at 6½c. per lb. Oleo stearine quiet at 10½c. per lb., a decline of ⅛c. per lb.

Miscellaneous Materials

Antimony—Cables from the Orient were higher and with arrivals here moderate selling pressure disappeared. Chinese antimony settled at 8¾@9c. per lb., an advance of ¼c. Cookson's "C" brand steady at 12½@13c. per lb. Chinese needle lump nominal at 8½@9c. per lb. Antimony oxide unchanged at 9@9½c. per lb.

Barytes — White floated material steady at $23 per ton, f.o.b. St. Louis. Demand continued good. Crude unchanged at $8@$8.50 per ton, f.o.b. mines.

Casein—Imported material available on spot at 10½@11c. per lb., according to grade and seller. Domestic nominal at 11@12c. per lb. Market barely steady on liberal offerings.

Glycerine—Closing prices from ¼@½c. lower. C.P. grade available on spot at 16½@16¾c. per lb., inside price obtaining on carload business. Dynamite sold recently at 15½c. per lb., carload basis, f.o.b. point of production. Soap lye crude, basis 80 per cent, unsettled at 10½c. per lb., loose. Saponification, 88 per cent, 11¾c. asked, loose, works.

Lithopone—Contract deliveries good, but new business inactive. Market reported steady at 6⅞@6½c. per lb., carload basis.

Naval Stores—Spirits of turpentine unsettled at 90@91c. per gal., a decline of 1c. for the week. Demand routine only. Rosins slightly higher, lower grades closing at $5.65@$5.70 per bbl.

White Lead, Etc.—Further weakness was in evidence in the market for the metal. The leading factor held the price of pig lead at 7.25c. per lb., but outside business was worked as low as 7.12½c. per lb. In spite of the recent sharp decline in lead corroders maintained the selling schedule for lead pigments on the old basis of 10½c. per lb. for standard dry white lead, in casks, carload lots. The deliveries of white lead against existing contracts were good, but new business was disappointing. The undertone was easy.

Zinc Oxide—There was a lower market for the metal, but no change occurred in the oxide. Demand for zinc oxide has been moderate for some time now and there are indications that certain sellers are more anxious to meet the views of buyers. American process, lead free oxide, held at 7½c. per lb. French process, red seal, closed unchanged at 9¾c. per lb.

Imports at the Port of New York

May 16 to May 22

ACIDS—Citric—100 csk., Messina, Order. **Cresylic** — 48 dr., Glasgow, Industrial Chemical Co.; 30 dr., Liverpool, W. E. Jordan & Bros. **Formic** — 140 demijohns, Rotterdam, R. W. Greeff & Co. **Barbituric**—16 cs., Antwerp, F. B. Vandegrift & Co. **Stearic**—63 bg., Rotterdam, Lamont, Corliss & Co.; 20 cs., Rotterdam, M. W. Parsons & Plymouth Lab. **Tartaric**—100 bbl., Bari, Superfos Co.

ACETONE OIL—25 dr., Trieste, Order.

ANTIMONY — 250 cs. crude, Shanghai, Hoyt Metal Co.; 500 cs. regulus, Shanghai, Banque Belge; 634 bg. ore, Antofagasta, Watson.

ANTIMONY OXIDE — 150 bg., Snanghai, National City Bank; 200 bbl. red, Havre, Heemsoth, Basse & Co.

BARIUM CHLORIDE—56 csk., Rotterdam, Goldschmidt Corp.; 131 csk., Hamburg, Order.

BARYTES—300 bg. ground, Hamburg, Cooper & Cooper; 200 bg., Bremen, P. Uhlich & Co.

BLEACHING POWDER—50 cs., Liverpool, H. Kohnstamm Co.

BONE BLACK — 897 bg., Bordeaux, Pomeroy & Fischer.

CHALK—406 bg., Hamburg, Chaplain & Bibbo; 475 bg., Bristol, H. J. Baker & Bros.; 115 bg., Antwerp, C. H. Chrystal & Co.; 500 bg., Antwerp, Lloyd Royal Belge; 1,500 bg., Antwerp, Order; 800,000 kilos, Dunkirk, J. W. Higman.

CHEMICALS—11 cs., Havre, Order; 50 csk., Rotterdam, Hans Hinrichs Chem. Co.; 618 bg., Glasgow, Brown Bros. & Co.; 280 bg., Glasgow, Coal & Iron National Bank; 560 bg., Glasgow, Bankers Trust Co.; 5 csk., Hamburg, C. Hardy, Inc.; 40 bbl., Hamburg, L. Sonneborn Sons; 2 cs., Hamburg, H. Falck & Co.; 10 bbl., Bremen, C. Hellmuth; 45 csk., Bremen, Order; 71 cs., Trieste, Order; 42 cs., Bremen, Roessler & Hasslacher Chemical Co.; 20 bbl., Bremen, C. Siegle Corp. of Am.

CHINA CLAY—364 tons, Bristol, Moore & Munger; 300 bg., Bristol, Bankers Trust Co.; 334 bg., Bristol, C. T. Wilson & Co.; 40 csk., Bristol, English China Clay Sales Corp.; 276 tons and 113 bg., Bristol, Order; 160 tons, Avonmouth Docks, Moore & Munger.

COAL-TAR DISTILLATE—99 dr., Liverpool, Order.

COBALT—100 bg. ore, Sydney, Order.

COLORS—19 csk. aniline, Havre, Ciba Co.; 19 pkg. do., Rotterdam, H. A. Metz & Co.; 6 csk. aniline, Hamburg, Franklin Import & Export Co.; 15 bbl., Bremen, C. Hellmuth; 1 cs. aniline, Genoa. American Exchange National Bank.

COPPER SULPHATE—100 bbl., Hamburg, Order.

CUTCH—10 bx., Glasgow, American Dyewood Co.

EPSOM SALT—500 bg., Bremen, Order.

FERROCHROMIUM — 64 csk., Gothenburg, C. Hardy, Inc.

FUSEL OIL—9 dr., Sourabaya, American Express Co.

GAMBIER—1,700 cs., Asahan, Order.

GLAUBER SALT—250 bg., Bremen, E. M. Sergeant & Co.

GLYCERINE—180 dr. crude, Rotterdam, Order; 60 dr. crude, Antwerp, Order.

GUMS—329 bg. yacca, Adelaide, Baring Bros. & Co.; 1,158 bg. do., Adelaide, Order; 150 cs. damar, Singapore, Order; 112 bg. copal, Manila, Chartered Bank of India, Australia & China; 100 bg. copal, Antwerp, Equitable Trust Co.; 40 bg. copal, Antwerp, Chase National Bank; 935 bg. do., Antwerp, Order; 63 bg. copal, Liverpool, Williams Shipping Agency; 210 bg. damar and 166 bg. copal, Singapore, L. C. Gillespie & Sons; 250 bg. arabic, Port Sudan, T. M. Duche & Sons; 300 bg. do., Port Sudan, Order; 100 cs. damar, Batavia, Cats American Corp.; 200 cs. do., Batavia, Irving Bank-Col. Trust Co.; 100 cs. do., Batavia, National City Bank; 400 cs. do., Batavia, Guaranty Trust Co.; 100 cs. do., Batavia, Stein, Hall & Co.; 300 cs. do., Batavia, Order; 100 cs. damar, Padang, American Exchange National Bank; 100 cs. do., Padang, Schultz & Ruckgaber; 300 cs. do., Padang, Order; 6,962 pkg. copal, Macassar, Order; 100 cs. damar, Batavia, Brown Bros. & Co.; 1,200 cs. do., Batavia, Order.

IRON OXIDE—185 bg., Bristol, G. Z. Collins & Co.; 55 csk., Bristol, Reichard-Coulston, Inc.; 10 csk., Bristol, A. Hurst & Co.; 21 csk., Liverpool, Reichard-Coulston, Inc.; 5 csk., London, C. D. Stone & Co.; 10 csk., Liverpool, Stanley Daggett Co.; 24 csk., Liverpool, J. A. McNulty.

IRON SULPHATE—43 bbl. Hamburg, Farmers Loan & Trust Co.

Opportunities in the Foreign Trade

Parties interested in any of the following opportunities may obtain all available information from the Bureau of Foreign and Domestic Commerce at Washington or from any district office of the bureau. The number placed after the opportunity must be given for the purpose of identification.

ACETIC ACID. Barmen, Germany. Purchase.—10,245.

ALCOHOL METHYL, wood naphtha, and formaldehyde. Konstanz, Germany. Purchase.—10,241.

ANILINE COLORS, especially black. Antwerp, Belgium. Purchase.—10,246.

ANILINE DYES, black, yellow and brown. Nuevo Laredo, Mexico. Purchase.—10,232.

CHEMICALS, HEAVY. Buenos Aires, Argentina. Agency.—10,258.

INSECTICIDES. Cape Town, South Africa. Agency.—10,198.

SODA ASH. Athens, Greece. Agency.—10,231.

SODIUM HYDROSULPHITE. The Hague, Netherlands. Exclusive agency.—10,236.

LITHOPONE—100 csk., Antwerp, E. M. & F. Waldo; 600 csk., Antwerp, B. Moore & Co.

LOGWOOD EXTRACT—20 csk., Savannah La Mar, J. Campbell & Co.; 20 csk., Kingston, J. Campbell & Co.

MANGROVE BARK—400 bg. extract, Singapore, Order; 500 bg., Singapore, Order.

MAGNESITE — 625 bg., Rotterdam, Speiden, Whitfield Co.; 313 bg., Rotterdam, A. Kramer Co.; 56 csk., Bombay, Order; 4,624 bg., Trieste, American-Austrian Magnesite Corp.

MANGANESE—18 csk. black, London, C. D. Stone & Co.

MYROBALANS — 4,394 bg., Bombay, National City Bank; 294 bg., Bombay, Order; 2,000 pkt., Calcutta, Amsinck, Sonne & Co.

NAPHTHALENE — 697 bg., Bristol, Order.

NICKEL SULPHATE—45 csk., Swansea, Gallagher & Ascher.

OILS — Coconut — 776 tons (in bulk) Manila, National Bank of Commerce; 750 tons (in bulk), Manila, Spencer Kellogg & Sons. **China Wood**—605 csk., Hankow, Standard Bank of South Africa; 757 csk., Hankow, Order; 443 csk., Shanghai, Bankers Trust Co.; 302 csk., Shanghai, Schulz & Ruckgaber. **Olive foots** (sulphur oil)—200 bbl., Bari, Banca Comm. Italo; 100 bbl. Bari, Brown Bros. & Co.; 200 bbl., Bari, Italian Discount & Trust Co.; 450 bbl., Bari, National City Bank; 300 bbl., Bari, W. R. Grace & Co.; 250 bbl., Bari, T. Toretti & Co.; 100 bbl., Bari, D. Antolino & Co.; 165 bbl. and 2 tanks, Bari, Palmolive Co.; 600 bbl., Patras, Order; 300 bbl., Bari, Banco Comm. Italo; 200 bbl., Catania, E. M. Sergeant & Co.; 75 bbl., Catania, National City Bank. **Palm**—268 csk., Hamburg, African & Eastern Trading Co. **Seal**—100 bbl. and 294 tons (in bulk), St. Johns, Bowring & Co.

OIL SEEDS—Copra—151 bg., Morant Bay, Franklin Baker Co.; 618 bg., Trinidad, National Park Bank; 204 bg., St. Anns Bay, Franklin Baker Co. **Castor**—133 bg., Port de Paix, Huttlinger & Stuller; 4,033 bg., Bombay, Order. **Linseed**—77,799 bg. and 4,101,142 kilos in bulk, Rosario, Order; 53,849 bg. and 2,032,000 kilos in bulk, Santa Fe, Order; 28,374 bg., Buenos Aires, Order; 8,510 bg., Buenos Aires, L. Dreyfus & Co.; 44,114 bg., Buenos Aires, Order. **Peanuts**—1,120 bg. shelled, Cheribon, Order.

PLUMBAGO—375 bbl., Colombo, Irving Bank-Col. Trust Co.; 114 bg., Colombo, H. W. Peabody & Co.; 334 bg. and 125 bbl., Colombo, N. Y. Trust Co.; 332 bg., Colombo, Brown Bros. & Co.

POTASSIUM SALTS—100 kegs chlorate, Antwerp, E. Suter & Co.; 1,000 bg. nitrate, Antwerp, Order; 500 bg. muriate, Antwerp, Societie Comm. des Potasses D'Alsace; 50 cs. caustic, Gothenburg, C. D. Stone & Co.; 25 cs. do., Gothenburg, Merck & Co.; 1,000 bg. muriate, Bremen, Potash Importing Corp. of America; 40 bbl. red prussiate, Trieste, E. Suter & Co.; 2,500 bg. muriate, Bremen, Potash Importing Corp. of Am.

QUEBRACHO—610 bg. extract, Buenos Aires, Beechman, Winthrop Co.

QUICKSILVER—33 flask, Tampico, G. Ramos.

SHELLAC—130 bg. garnet, Hamburg, Irving Bank-Col. Trust Co.; 14 cs. do., Hamburg, Order; 200 bg., London, A. Helmrath & Co.; 250 bg., Calcutta, British Oversea Bank; 300 bg., Calcutta, Arbuthnot, Latham & Co.; 100 bg., Calcutta, First National Bank, Boston; 100 bg., Calcutta, N. Y. Trust Co.; 800 bg., Calcutta, Order.

SILVER SULPHIDE—23 cs., Antofagasta, Watson, Geach & Co.

SODIUM SALTS—41 csk. prussiate, Rotterdam, Meteor Products Co.; 30 csk. prussiate, Rotterdam, Order; 100 csk. hyposulphite, Hamburg, C. Hardy, Inc.; 39 bbl. phosphate, Antwerp, A. Klipstein & Co.; 67 csk. do., Antwerp, E. Suter & Co.; 167 csk. phosphate, Antwerp, Roessler & Hasslacher Chemical Co.; 500 csk. nitrate, Hamburg, Order; 60 cs. cyanide, Liverpool, American-British Chemical Co.; 23 cs. prussiate, Liverpool, Order; 12,800 bg. nitrate, Antofagasta, W. R. Grace & Co.; 17,297 bg. do., Iquique, W. R. Grace & Co.; 150 bg. fluosilicate, Venice, Order.

TALC—100 bg., Bordeaux, Whittaker, Clark & Daniels; 200 bg. and 50 cs., Bordeaux, Order.

VANADIUM—3,193 bg., Callao, Vanadium Corp. of Am.

VERMILION—5 csk., London, Pomeroy & Fischer.

WAXES—216 bg. carnauba, Ceara, Lazard Freres; 265 bg., Ceara, Order; 16 bg. ozokerite, Trieste, W. K. Jahn & Co.; 26 bg. beeswax, Alexandria, Order; 10 bbl. beeswax, Rotterdam, Order; 8 pkg. do., Monte Christi, Order; 46 bg. mineral, Hamburg, L. G. Tainter; 40 bg. beeswax, Coquimbo, W. R. Grace & Co.; 21 bg. do., Valparaiso, Banco Aleman Trans.; 30 bg. do., Valparaiso, Strohmeyer & Arpe Co.; 111 bg. do., Valparaiso, W. R. Grace & Co.; 74 bg. do., Valparaiso, A. Trevana; 22 bg. do., Talcahuano, W. R. Grace & Co.; 7,200 bg. paraffine, Balikpapan, Asiatic Petroleum Co.

WOOL GREASE — 90 bbl., Antwerp, Order; 7 bbl., Hamburg, H. A. Metz & Co.

WHITING—200 bg., Bremen, C. B. Chrystal Co.

ZINC OXIDE—125 csk., Antwerp, E. M. & F. Waldo.

ZIRCONIUM ORE—34 tons, Santos, Electro Metals Co.

Current Prices in the New York Market

For Chemicals, Oils and Allied Products

THESE prices are for the spot market in New York City, but a special effort has been made to report American manufacturers' quotations whenever available. In many cases these are for material f.o.b. works or on a contract basis and these prices are so designated. Quotations on imported stocks are reported when they are of sufficient importance to have a material effect on the market. Prices quoted in these columns apply to large quantities in original packages.

General Chemicals

Acetone, drums, wks.	lb.	$0.15 –	$0.15½
Acetic anhydride, 85%, dr.	lb.	.38 –	....
Acid, acetic, 28%, bbl.	100 lb.	3.12 –	3.37
Acetic, 56%, bbl.	100 lb.	5.85 –	6.10
Acetic, 80%, bbl.	100 lb.	8.19 –	8.44
Glacial, 99½%, bbl.	100 lb.	11.01 –	11.51
Boric, bbl.	lb.	.09 –	.09½
Citric, kegs	lb.	.47 –	.48
Formic, 85%	lb.	.12½–	.13
Gallic, tech.	lb.	.45 –	.50
Hydrofluoric, 52%, carboys	lb.	.11 –	.12
Lactic, 44%, tech., light, bbl.	lb.	.12½–	.13
22% tech., light, bbl.	lb.	.06 –	.06½
Muriatic, 18° tanks	100 lb.	.80 –	.85
Muriatic, 20°, tanks	100 lb.	.95 –	1.00
Nitric, 36°, carboys	lb.	.04 –	.04½
Nitric, 42°, carboys	lb.	.04½–	.05½
Oleum, 20%, tanks	ton	16.00 –	17.00
Oxalic, crystals, bbl.	lb.	.09½–	.10
Phosphoric, 50% carboys	lb.	.07 –	.08
Pyrogallic, resublimed	lb.	1.55 –	1.60
Sulphuric, 60°, tanks	ton	9.00 –	10.00
Sulphuric, 60°, drums	ton	13.00 –	14.00
Sulphuric, 66°, tanks	ton	14.00 –	15.00
Sulphuric, 66° drums	ton	19.00 –	20.00
Tannic, U.S.P., bbl.	lb.	.65 –	.70
Tannic, tech., bbl.	lb.	.45 –	.50
Tartaric, imp., powd., bbl.	lb.	.27 –	.28
Tartaric, domestic, bbl.	lb.	.30 –	....
Tungstic, per lb.	lb.	1.20 –	1.25
Alcohol, butyl, drums, f.o.b. works	lb.	.25 –	.30
Alcohol ethyl (Cologne spirit), bbl.	gal.	4.83 –	....
Ethyl, 190 p'f. U.S.P., bbl.	gal.	4.81 –	....
Alcohol, methyl (see Methanol)			
Alcohol, denatured, 190 proof			
No. 1, special bbl.	gal.	.51½–	...
No. 1, 190 proof, special, dr.	gal.	.45½–	...
No. 1, 188 proof, bbl.	gal.	.52½–	...
No. 1, 188 proof, dr.	gal.	.48½–	...
No. 5, 188 proof, bbl.	gal.	.50½–	...
No. 5, 188 proof, dr.	gal.	.44½–	...
Alum, ammonia, lump, bbl.	lb.	.03½–	.04
Potash, lump, bbl.	lb.	.02½–	.03½
Chrome, lump, potash, bbl.	lb.	.05½–	.06
Aluminum sulphate, com., bags	100 lb.	1.35 –	1.40
Iron free bags		2.35 –	2.45
Aqua ammonia, 26°, drums	lb.	.06½–	.06½
Ammonia, anhydrous, cyl.	lb.	.28 –	.30
Ammonium carbonate, powd. tech., casks	lb.	.12 –	.13
Ammonium nitrate, tech., casks	lb.	.09 –	.10
Amyl acetate tech., drums	gal.	3.00 –	3.25
Antimony oxide, white, bbl.	lb.	.09½–	.09½
Arsenic, white, powd., bbl.	lb.	.08½–	.09½
Arsenic, red, powd., kegs	lb.	.14½–	.15½
Barium carbonate, bbl.	ton	64.00 –	68.00
Barium chloride, bbl.	ton	87.00 –	88.00
Barium dioxide, 88%, drums	lb.	.17½–	.18
Barium nitrate, casks		.08 –	.08½
Blanc fixe, dry, bbl.	lb.	.03½–	.04
Bleaching powder, f.o.b. wks., drums	100 lb.	1.90 –	....
Spot N. Y. drums	100 lb.	2.25 –	2.35
Borax, bbl.	lb.	.05 –	.05½
Bromine, cases	lb.	.28 –	.30
Calcium acetate, bags	100 lb.	3.00 –	3.05
Calcium arsenate, dr.	lb.	.10½–	.11
Calcium carbide, drums	lb.	.05 –	.05½
Calcium chloride, fused, dr. wks.	ton	21.00 –	....
Gran. drums works	ton	27.00 –	....
Calcium phosphate, mono, bbl.	lb.	.06½–	.07½
Camphor, Jap. cases	lb.	.73 –	.74
Carbon bisulphide, drums	lb.	.06 –	.06½
Carbon tetrachloride, drums	lb.	.07 –	.07½
Chalk, precip.—domestic, light, bbl.	lb.	.04½–	.04½
Domestic, heavy, bbl.	lb.	.03½–	.04
Imported, light, bbl.	lb.	.04½–	.05
Chlorine, liquid, tanks, wks.	lb.	.04½–	....
Contract, tanks, wks.	lb.	.04½–	....
Cylinders, 100 lb., wks.	lb.	.05½–	.07½
Chloroform, tech., drums	lb.	.30 –	.32
Cobalt, oxide, bbl.	lb.	2.10 –	2.25
Copperas, bulk, f.o.b. wks.	ton	16.00 –	18.00
Copper carbonate, bbl.	lb.	.16½–	.16½
Copper cyanide, drums	lb.	.45 –	.46
Copper sulphate, dom., bbl., 100 lb.		4.65 –	4.80
Imp. bbl.	100 lb.	4.25 –	4.50
Cream of tartar, bbl.	lb.	.20½–	.21
Epsom salt, dom., tech., bbl.	100 lb.	1.75 –	2.00
Epsom salt, imp., tech., bags	100 lb.	1.15 –	1.25
Epsom salt, U.S.P., dom., bbl.	100 lb	2.10 –	2.35
Ether, U.S.P., dr.	lb.	.14 –	.15
Ethyl acetate, 85%, drums	gal.	.92 –	.95
Ethyl acetate, 99%, dr.	gal.	$1.08 –	$1.10
Formaldehyde, 40%, bbl.	lb.	.09½–	.10
Fullers earth—f.o.b. mines	ton	7.50 –	18.00
Furfural, works, bbl.	lb.	.25 –	....
Fusel oil, ref., drums	gal.	3.50 –	4.00
Fusel oil, crude, drums	gal.	2.50 –	2.75
Glaubers salt, wks., bags	100 lb.	1.20 –	1.40
Glaubers salt, imp., bags	100 lb.	1.00 –	1.05
Glycerine, c.p., drums extra	lb.	.16½–	.16¾
Glycerine, dynamite, drums	lb.	.15½–	....
Glycerine, crude 80%, loose	lb.	.10½–	.10½
Hexamethylene, drums	lb.	.65 –	.75
Lead:			
White, basic carbonate, dry, casks	lb.	.10½–	....
White, basic sulphate, casks	lb.	.09½–	....
White, in oil, kegs	lb.	.12½–	....
Red, dry, casks	lb.	.12 –	....
Red, in oil, kegs	lb.	.13½–	....
Lead acetate, white crys., bbl.	lb.	.14½–	....
Brown, broken, casks	lb.	.13½–	....
Lead arsenate, powd., bbl.	lb.	.16 –	.18
Lime-Hydrated, bg. wks.	ton	10.50 –	12.50
Bbl., wks.	ton	18.00 –	19.00
Lime, Lump, bbl.	280 lb.	3.63 –	3.65
Litharge, comm., casks	lb.	.11½–	....
Lithopone, bags	lb.	.06½–	.06¾
Magnesium carb., tech., bags	lb.	.08½–	.08½
Methanol, 95%, bbl.	gal.	.80 –	....
Methanol, 97%, bbl.	gal.	.82 –	....
Methanol, pure, tanks	gal.	.80 –	....
drums	gal.	.82 –	....
bbl.	gal.	.87 –	....
Methyl-acetone, t'ks.	gal.	.75 –	....
Nickel salt, double, bbl.	lb.	.09½–	.10½
Nickel salts, single, bbl.	lb.	.10½–	.11
Orange mineral, csk.	lb.	.14½–	.15½
Phosgene		.60 –	.75
Phosphorus, red, cases	lb.	.70 –	.75
Phosphorus, yellow, cases	lb.	.35 –	.40
Potassium bichromate, casks	lb.	.09½–	.09½
Potassium bromide, gran., bbl.	lb.	.20 –	.32
Potassium carbonate, 80-85%, calcined, casks	lb.	.05½–	.05½
Potassium chlorate, powd.	lb.	.07½–	.08½
Potassium cyanide, drums	lb.	.47 –	.52
Potassium, first sorts, cask	lb.	.07½–	.08
Potassium hydroxide (caustic potash) drums	lb.	.06½–	.07
Potassium iodide, cases	lb.	3.65 –	3.75
Potassium nitrate, bbl.	lb.	.06 –	.07½
Potassium permanganate, drums	lb.	.14½–	.14½
Potassium prussiate, red, casks	lb.	.35 –	.38
Potassium prussiate, yellow, casks	lb.	.18½–	.19
Salammoniac, white, gran., casks, imported	lb.	.06½ –	.06½
Salammoniac, white, gran., bbl., domestic	lb.	.07½–	.07½
Gray, gran., casks	lb.	.08 –	.09
Salsoda, bbl.	100 lb.	1.20	1.40
Salt cake (bulk) works	ton	18.00 –	20.00
Soda ash, light, 58% flat, bulk, contract	100 lb.	1.25 –	....
bags, contract	100 lb.	1.38 –	....
Soda ash, dense, bulk, contract, basis 58%	100 lb.	1.35 –	....
bags, contract	100 lb.	1.45 –	....
Soda, caustic, 76%, solid, drums contract	100 lb.	3.10 –	....
Soda, caustic, ground and flake, contracts, dr.	100 lb.	3.50 –	3.85
Soda, caustic, solid, 76% f. a.s. N. Y.	100 lb.	3.00 –	....
Sodium acetate, works, bbl.	lb.	.05 –	.05½
Sodium bicarbonate, bulk	100 lb.	1.75 –	....
330-lb. bbl.	100 lb.	2.00 –	....
Sodium bichromate, casks	lb.	.07½–	.07½
Sodium bisulphate (niter cake)	ton	6.00 –	7.00
Sodium bisulphite, powd., U.S.P., bbl.	lb.	.04½–	.04½
Sodium chlorate, kegs	lb.	.06½–	.07
Sodium chloride	long ton	12.00 –	13.00
Sodium cyanide, cases	lb.	.19 –	.22
Sodium fluoride, bbl.	lb.	$0.08½–	$0.10
Sodium hyposulphite, bbl.	lb.	.02½–	.02½
Sodium nitrite, casks	lb.	.08½–	.08½
Sodium peroxide, powd., cases	lb.	.28 –	.30
Sodium phosphate, dibasic, bbl.	lb.	.03½–	.03½
Sodium prussiate, yel. bbl.	lb.	.09½–	.11
Sodium salicylic, drums	lb.	.38 –	.40
Sodium silicate (40°, drums)	100 lb.	.75 –	1.15
Sodium silicate (60°, drums)	100 lb.	1.75 –	2.00
Sodium sulphide, fused, 60-62% drums	lb.	.03½–	.03½
Sodium sulphite, crys., bbl.	lb.	.02½–	.03
Strontium nitrate, powd., bbl.	lb.	.10 –	.10½
Sulphur chloride, yel drums	lb.	.04½–	.05
Sulphur, crude	ton	18.00 –	20.00
At mine, bulk	ton	16.00 –	18.00
Sulphur, flour, bag	100 lb.	2.25 –	2.35
Sulphur, roll, bag	100 lb.	2.00 –	2.10
Sulphur dioxide, liquid, cyl.	lb.	.08 –	.08
Tin bichloride, bbl.	lb.	.13½–	....
Tin oxide, bbl.	lb.	.52 –	....
Tin crystals, bbl.	lb.	.35 –	....
Zinc carbonate, bags	lb.	.14 –	.14½
Zinc chloride, gran, bbl.	lb.	.05 –	.05½
Zinc cyanide, drums	lb.	.36½–	.37
Zinc dust, bbl.	lb.	.08 –	.08½
Zinc oxide, lead free, bag	lb.	.07½–	....
5% lead sulphate, bags	lb.	.07½–	....
10 to 35 % lead sulphate, bags	lb.	.07 –	....
French, red seal, bags	lb.	.09½–	....
French, green seal, bags	lb.	.10½–	....
French, white seal, bbl.	lb.	.12 –	....
Zinc sulphate, bbl.	100 lb.	3.00 –	3.25

Coal-Tar Products

Alpha-naphthol, crude, bbl.	lb.	$0.60 –	$0.65
Alpha-naphthol, ref., bbl.	lb.	.75 –	.80
Alpha-naphthylamine, bbl.	lb.	.35 –	.36
Aniline oil, drums	lb.	.16 –	.16½
Aniline salt, bbl.	lb.	.22½–	.23
Anthracene, 80%, drums	lb.	.75 –	.80
Anthraquinone, 25%, paste, drums	lb.	.75 –	.80
Benzaldehyde U.S.P., carboys	lb.	1.50 –	....
f.f.e. drums	lb.	1.60 –	....
tech, drums	lb.	68	.72
Benzene, pure, water-white, tanks, works	gal.	.25 –	....
Benzene, 90%, tanks, works	gal.	.23 –	....
Benzidine base, bbl.	lb.	.80 –	.82
Benzidine sulphate, bbl.	lb.	.70 –	.72
Benzoic acid, U.S.P., kegs	lb.	.82 –	85
Benzoate of soda, U.S.P., bbl.	lb.	.67 –	.72
Benzyl chloride, 95-97%, ref., carboys	lb.	.35 –	....
Benzyl chloride, tech., drums	lb.	.25 –	....
Beta-naphthol, tech., bbl.	lb.	.24 –	.25
Beta-naphthylamine, tech.	lb.	.65 –	.70
Cresol, U.S.P., drums	lb.	.23 –	.28
Ortho-cresol, drums	lb.	.28 –	.32
Cresylic acid, 97%, works drums	gal.	.65 –	.70
95-97%, drums, works	gal.	.60 –	.65
Dichlorbenzene, drums	lb.	.07 –	.08
Diethylaniline, drums	lb.	.55 –	....
Dimethylaniline, drums	lb.	.36 –	.38
Dinitrobenzene, bbl.	lb.	.15 –	.17
Dinitrochlorbenzene, bbl.	lb.	.21 –	.22
Dinitronaphthalen, bbl.	lb.	.30 –	.32
Dinitrophenol, bbl.	lb.	.35 –	.40
Dinitrotoluen, bbl.	lb.	.18 –	.20
Dip oil, 25%, drums	gal.	.26 –	.28
Diphenylamine, bbl.	lb.	.48 –	.50
H-acid, bbl.	lb.	.72 –	.75
Meta-phenylenediamine, bbl.	lb.	.95 –	1.00
Michlers ketone, bbl.	lb.	3.00 –	3.50
Monochlorbenzene, drums	lb.	.08 –	.10
Monoethylaniline, drums	lb.	.95 –	1.10
Naphthalene, flake, bbl.	lb.	.05 –	.05½
Naphthalene, balls, bbl.	lb.	.06 –	.06½
Naphthionate of soda, bbl.	lb.	.60 –	.65
Naphthionic acid, crude, bbl.	lb.	.60 –	.62
Nitrobenzene, drums	lb.	.09 –	.09½
Nitro-naphthalene, bbl.	lb.	.25 –	.30
Nitro-toluene, drums	lb.	.13½–	.14
N-W acid, bbl.	lb.	1.00 –	1.05
Ortho-amidophenol, kegs	lb.	2.40 –	2.50
Ortho-dichlorbenzene, drums	lb.	.12 –	.13
Ortho-nitrophenol, bbl.	lb.	1.25 –	1.30
Ortho-nitrotoluene, drums	lb.	.11 –	.12
Ortho-toluidine, bbl.	lb.	.12 –	.13
Para-aminophenol, base, kegs	lb.	1.20 –	1.25
Para-aminophenol, HCl, kegs	lb.	1.30 –	1.40
Para-dichlorbenzene, bbl.	lb.	.17 –	.20
Paranitraniline, bbl.	lb.	.68 –	.70
Para-nitrotoluene, bbl.	lb.	.58 –	.60
Para-phenylenediamine, bbl.	lb.	1.40 –	1.50
Para-toluidine, bbl	lb.	.72 –	.80
Phthalic anhydride, bbl.	lb.	.30 –	.34
Phenol, U.S.P., dr.	lb.	.26 –	.28
Picric acid, bbl.	lb.	.20 –	.22
Pitch, tanks, works	ton	25.00 –	30.00
Pyridine, imp., drums	gal.	5.25 –	5.50
Resorcinol, tech., kegs	lb.	1.30 –	1.40

Resorcinol, pure, kegs	lb.	$2.00 –	$2.10
R-salt, bbl.	lb.	.55 –	.60
Salicylic acid, tech., bbl.	lb.	.31 –	.32
Salicylic acid, U.S.P., bbl.	lb.	.35 –	....
Solvent naphtha, water-white, tanks	gal.	.25 –	....
Crude, tanks	gal.	.22 –	....
Sulphanilic acid, crude, bbl.	lb.	.16 –	.18
Tolidine, bbl.	lb.	1.00 –	1.05
Toluidine, mixed, kegs	lb.	.30 –	.35
Toluene, tank cars, works	gal.	.26 –	....
Toluene, drums, works	gal.	.30 –	....
Xylidine, drums	lb.	.48 –	.50
Xylene, 5 deg.-tanks	gal.	.40 –	....
Xylene, com., tanks	gal.	.28 –	....

Naval Stores

Rosin B-D, bbl. 280 lb.		$5.60 –	$5.70
Rosin E-I, bbl. 280 lb.		5.75 –	.....
Rosin K-N, bbl. 280 lb.		5.90 –	6.10
Rosin W.G.-W.W., bbl. 280 lb.		7.00 –	7.60
Wood rosin, bbl. 280 lb.		5.80 –	5.90
Turpentine, spirits of, bbl.	gal.	.89 –	.90
Wood, steam dist., bbl.	gal.	.85 –	.....
Wood, dest. dist., bbl.	gal.	.67 –	.....
Pine tar pitch, bbl. 200 lb.		5.50 –	.....
Tar, kiln burned, bbl. 500 lb.		10.50 –	.....
Retort tar, bbl. 500 lb.		10.50 –	.....
Rosin oil, first run, bbl.	gal.	.41 –	.....
Rosin oil, second run, bbl.	gal.	.45 –	.....
Rosin oil, third run, bbl.	gal.	.47 –	.....
Pine oil, steam dist.	gal.	.65 –	.....
Pine tar oil, ref.	gal.	.50 –	.....

Animal Oils and Fats

Degras, bbl.	lb.	$0.03½–	$0.05½
Grease, yellow, loose	lb.	.06½–	.06½
Lard oil, Extra No. 1, bbl.	gal.	.85 –	.....
Lard compound, bbl.	lb.	.11½–	.11½
Neatsfoot oil 20 deg. bbl.	gal.	1.26 –	.....
No. 1, bbl.	gal.	.86 –	.88
Oleo Stearine	lb.	.10½–	.....
Oleo oil, No. 1, bbl.	lb.	.13 –	.....
Red oil distilled, d.p. bbl.	lb.	.08½–	.09½
Saponified, bbl.	lb.	.08½–	.09½
Tallow, extra, loose works	lb.	.07 –	.....
Tallow oil, acidless, bbl.	gal.	.82 –	.....

Vegetable Oils

Castor oil, No. 3, bbl.	lb.	$0.15½–	.....
Castor oil, No. 1, bbl.	lb.	.16 –	.....
Chinawood oil, bbl.	lb.	.14½–	.14½
Coconut oil, Ceylon, bbl.	lb.	.09½–	.....
Ceylon, tanks, N.Y.	lb.	.08 –	.08½
Cocoanut oil, Cochin, bbl.	lb.	.09½–	.....
Corn oil, crude, bbl.	lb.	.10½–	.11
Crude, tanks, (f.o.b. mill)	lb.	.08½–	.....
Cottonseed oil, crude (f.o.b. mill), tanks	lb.	.08 –	.....
Summer yellow, bbl.	lb.	.09½–	.....
Winter yellow, bbl.	lb.	.11 –	.11½
Linseed oil, raw, car lots, bbl.	gal.	.94 –	.....
Raw, tank cars (dom.)	gal.	.88 –	.....
Boiled, cars, bbl. (dom.)	gal.	.96 –	.....
Olive oil, denatured, bbl.	gal.	1.25 –	1.30
Sulphur, (foots) bbl.	lb.	.09½–	.09½
Palm, Lagos, casks	lb.	.07½–	.07½
Niger, casks	lb.	.06½–	.....
Palm kernel, bbl.	lb.	.08½–	.09½
Peanut oil, crude, tanks (mill)	lb	.11 –	.....
Peanut oil, refined, bbl.	lb.	.14½–	.14½
Perilla, bbl.	lb.	.14 –	.14½
Rapeseed oil, refined, bbl.	gal.	.82 –	.83
Sesame, bbl.	lb.	.11½–	.11½
Soya bean (Manchurian), bbl.	lb.	.11½–	.....
Tank, f.o.b. Pacific coast	lb.	.09½–	.10
Tank, (f.o.b. N.Y.)	lb.	.10½–	.....

Fish Oils

Cod, Newfoundland, bbl.	gal.	$0.62 –	$0.65
Menhaden, light pressed, bbl.	gal.	.60 –	.....
White bleached, bbl.	gal.	.62 –	.....
Blown, bbl.	gal.	.66 –	.....
Crude, tanks (f.o.b. factory)	gal.	.47½–	.50
Whale No. 1 crude, tanks, coast	lb.	..... –	.....
Winter, natural, bbl.	gal.	.75 –	.76
Winter, bleached, bbl.	gal.	.78 –	.79

Oil Cake and Meal

Cocoanut cake, bags	ton	$28.00 –	29.00
Cottonseed meal, f.o.b. mills	ton	34.00 –	35.00
Linseed cake, bags	ton	33.00 –	34.00
Linseed meal, bags, spot	ton	39.00 –	41.00

Dye & Tanning Materials

Albumen, blood, bbl.	lb.	$0.50 –	$0.55
Albumen, egg, tech, kegs	lb.	.95 –	.97
Cochneal, bags	lb.	.32 –	.34
Cutch, Borneo, bales	lb.	.04½–	.04½
Cutch, Rangoon, bales	lb.	.13½–	.14½
Dextrine, corn, bags 100 lb.		3.64 –	3.91
Dextrine, gum, bags 100 lb.		3.99 –	4.09
Divi-divi, bags	ton	40.00 –	42.00
Fustic, sticks	ton	30.00 –	35.00
Fustic, chips, bags	lb.	.04 –	.05
Gambier com., bags	lb.	.11 –	.12
Logwood, sticks	ton	25.00 –	26.00
Logwood, chips, bags	lb.	.02½–	.03
Sumac, leaves, Sicily, bags	ton	..... –	.....
Sumac, ground, bags	ton	160.00 –	170.00
Sumac, domestic, bags	ton	50.00 –	55.00
Starch, corn, bags 100 lb.		3.07 –	3.33
Tapioca flour, bags	lb.	.05½–	.06½

Extracts

Archil, conc., bbl.	lb.	$0.16½–	$0.20
Chestnut, 25% tannin, tanks	lb.	.01½–	.02½
Divi-divi, 25% tannin, bbl.	lb.	.04 –	.05
Fustic, crystals, bbl.	lb.	.20 –	.22
Fustic, liquid, 42°, bbl.	lb.	.08 –	.09
Gambier, liq., 25% tannin, bbl.	lb.	.09½–	.10
Hematine crys., bbl.	lb.	.14 –	.18
Hemlock, 25% tannin, bbl.	lb.	.03½–	.04
Hypernic, solid, drums	lb.	.24 –	.26
Hypernic, liquid, 51°, bbl.	lb.	.09½–	.10½
Logwood, crys., bbl.	lb.	.14 –	.15
Logwood, liq., 51°, bbl.	lb.	.08 –	.09
Osage Orange, 51°, liquid, bbl.	lb.	.07 –	.08
Osage Orange, powder, bg.	lb.	.14 –	.15
Quebracho, solid, 65% tannin, bbl.	lb.	.05 –	.05½
Sumac, dom., 51°, bbl.	lb.	.07 –	.07½

Dry Colors

Blacks–Carbongas, bags, f.o.b. works, contract	lb.	$0.99 –	$0.11
spot, cases	lb.	.12 –	.16
Lampblack, bbl.	lb.	.12 –	.40
Mineral, bulk	ton	35.00 –	45.00
Blues–Bronze, bbl.	lb.	.38 –	.42
Prussian, bbl.	lb.	.38 –	.42
Ultramarine, bbl.	lb.	.08 –	.35
Browns, Sienna, Ital., bbl.	lb.	.06 –	.14
Sienna, Domestic, bbl.	lb.	.03½–	.04
Umber, Turkey, bbl.	lb.	.04 –	.04½
Greens–Chrome, C.P. Light, bbl.	lb.	.28 –	.30
Chrome, commercial, bbl.	lb.	.11½–	.12
Paris, bulk	lb.	.26 –	.27
Reds Carmine No. 40, tins	lb.	4.25 –	4.50
Iron oxide red, casks	lb.	.10 –	.16
Para toner, kegs	lb.	1.00 –	1.10
Vermilion, English, bbl.	lb.	1.35 –	1.40
Yellow, Chrome, C.P. bbls.	lb.	.17 –	.18
Ocher, French, casks	lb.	.02½–	.03

Waxes

Bayberry, bbl.	lb.	$0.20 –	$0.21
Beeswax, crude, Afr. bg.	lb.	.25 –	.25½
Beeswax, refined, light, bags	lb.	.32 –	.34
Beeswax, pure white, cases	lb.	.40 –	.41
Candelilla, bags	lb.	.23 –	.23½
Carnauba, No. 1, bags	lb.	.38 –	.39
No. 2, North Country, bags	lb.	.29 –	.30
No. 3, North Country, bags	lb.	.21½–	.22½
Japan, cases	lb.	.24 –	.25
Montan, crude, bags	lb.	.05½–	.06
Paraffine, crude, match, 105-110 m.p., bbl.	lb.	.05½–	.....
Crude, scale 124-126 m.p. bags	lb.	.04½–	.05
Ref., 118-120 m.p., bags	lb.	.05½–	.....
Ref., 123-125 m.p., bags	lb.	.05½–	.....
Ref., 128-130 m.p., bags	lb.	.05½–	.....
Ref., 133-135 m.p., bags	lb.	.06 –	.....
Ref., 135-137 m.p., bags	lb.	.06½–	.07
Stearic acid, sgle pressed, bags	lb.	.11 –	.11½
Double pressed, bags	lb.	.11½–	.11½
Triple pressed, bags	lb.	.13 –	.13½

Fertilizers

Acid phosphate, 16%, bulk, works	ton	$7.50 –	$7.75
Ammonium sulphate, bulk f.o.b. works 100 lb.		2.60 –	.....
Blood, dried, bulk	unit	4.10 –	4.15
Bone, raw, 3 and 50, ground	ton	26.00 –	28.00
Fish scrap, dom., dried, wks.	unit	..... –	.....
Nitrate of soda, bags 100 lb.		2.50 –	.....
Tankage, high grade, f.o.b. Chicago	unit	2.20 –	.....
Phosphate rock, f.o.b. mines			
Florida pebble, 68-72%	ton	3.40 –	.....
Tennessee, 75%	ton	6.75 –	7.00
Potassium muriate, 80%, bags	ton	34.55 –	.....
Potassium sulphate, bags basis 90%	ton	45.85 –	.....
Double manure salt	ton	26.35 –	.....
Kainit	ton	7.22 –	.....

Crude Rubber

Para—Upriver fine	lb.	$0.18½–	.....
Upriver coarse	lb.	.14 –	.14½
Upriver caucho ball	lb.	.14½–	.15
Plantation—First latex crepe	lb.	.19 –	.....
Ribbed smoked sheets	lb.	.18½–	.18½
Amber crepe No. 1	lb.	.18 –	.18½

Gums

Copal, Congo, amber, bags	lb.	$0.09 –	$0.14
East Indian, bold, bags	lb.	.14 –	.15
Manila, pale, bags	lb.	.18 –	.19
Pontinak, No. 1 bags	lb.	.19 –	.20
Damar, Batavia, cases	lb.	.23 –	.23½
Singapore, No. 1, cases	lb.	.28 –	.29
Singapore, No. 2, cases	lb.	.19½–	.20
Kauri, No. 1, cases	lb	.60 –	.65
Ordinary chips, cases	lb.	.21 –	.22
Manjak, Barbados, bags	lb.	.08 –	.11

Shellac

Shellac, orange fine, bags	lb.	$0.56 –	.....
Orange superfine, bags	lb.	.58 –	.....
A. C. garnet, bags	lb.	.52 –	.....
Bleached, bonedry	lb.	.64 –	$0.65
Bleached, fresh	lb.	.53 –	.54
T. N., bags	lb.	.54 –	.55

Miscellaneous Materials

Asbestos, crude No. 1, f.o.b., Quebec	sh. ton	$300.00 –	$400.00
Asbestos, shingle, f.o.b., Quebec	sh. ton	50.00 –	70.00
Asbestos, cement, f.o.b., Quebec	sh. ton	20.00 –	25.00
Barytes, grd, white, f.o.b. mills, bbl.	net ton	16.00 –	17.00
Barytes, grd., off-color, f.o.b. Balt.	net ton	13.00 –	14.00
Barytes, floated, f.o.b. St. Louis, bbl.	net ton	23.00 –	24.00
Barytes, crude f.o.b. mines, bulk	net ton	8.00 –	8.50
Casein, bbl., tech	lb.	.10½–	.11½
China clay (kaolin) crude, No. 1, f.o.b. Ga.	net ton	7.00 –	8.00
Washed, f.o.b. Ga.	net ton	8.50 –	9.00
Powd., f.o.b. Ga.	net ton	14.00 –	20.00
Crude f.o.b. Va.	net ton	6.00 –	8.00
Ground, f.o.b. Va.	net ton	13.00 –	19.00
Imp., lump, bulk	net ton	15.00 –	20.00
Imp., powd.	net ton	45.00 –	50.00
Feldspar, No. 1 f.o.b. N.C.	long ton	7.00 –	7.50
No. 2 f.o.b. N.C.	long ton	4.50 –	5.00
No. 1 soap	long ton	7.00 –	.....
No. 1 Canadian, f.o.b. mill, powd.	long ton	20.00 –	.....
Graphite, Ceylon, lump, first quality, bbl.	lb.	.05½–	.06
Ceylon, chip, bbl.	lb.	.04½–	.05
High grade amorphous crude	ton	15.00 –	35.00
Gum arabic, amber, sorts, bags	lb.	.12½–	.13
Gum tragacanth, sorts, bags	lb.	.48 –	.50
No. 1, bags	lb.	1.20 –	.....
Kieselguhr, f.o.b. Cal.	ton	40.00 –	42.00
F.o.b. N. Y.	ton	50.00 –	55.00
Magnesite, calcined, f.o.b. Cal.	ton	35.00 –	45.00
Pumice stone, imp., casks	lb.	.03 –	.40
Dom., lump, bbl.	lb.	.06 –	.08
Dom., ground, bbl.	lb.	.03 –	.05
Silica, glass sand, f.o.b. Ind.	ton	2.00 –	2.50
Silica, sand blast, f.o.b. Ind.	ton	2.25	3.50
Silica, amorphous, 200-mesh, f.o.b. Ill.	ton	20.00 –	.....
Silica, glass sand, f.o.b. Ill.	ton	1.75 –	3.00
Soapstone, coarse, f.o.b. Vt., bags	ton	7.50 –	8.00
Talc, 200 mesh, f.o.b., Vt., bags, extra	ton	10.50 –	.....
Talc, 200 mesh, f.o.b. Ga., bags	ton	8.00 –	12.00
Talc, 325 mesh, f.o.b. New York, grade A bags	ton	14.75 –	.....

Mineral Oils

Crude, at Wells

Pennsylvania	bbl.	$3.75 –	$4.25
Corning	bbl.	2.15 –	.....
Cabell	bbl.	1.95 –	.....
Somerset	bbl.	2.05 –	2.25
Illinois	bbl.	2.07 –	.....
Indiana	bbl.	2.08 –	.....
Kansas and Okla. under 28 deg.	bbl.	1.00 –	.....
California, 35 deg. and up	bbl.	1.40 –	.....

Gasoline, Etc.

Motor gasoline, steel bbls.	gal.	$0.20 –	.....
Naphtha, V. M. & P. deod, steel bbls	gal	.19 –	.....
Kerosene, ref. tank wagon	gal.	.14½–	.15
Bulk, W.W. delivered, N.Y.	gal.	.08½–	.....
Lubricating oils:			
Cylinder, Penn., filtered	gal.	.32 –	.38
Bloomless, 30@31 grav.	gal.	.21½–	.22
Paraffin, pale 885 vis	gal.	.17 –	.17½
Spindle, 200, pale	gal.	.22 –	.....
Petrolatum, amber, bbls.	lb.	.04½–	.04½
Paraffine wax (see waxes)			

Refractories

Bauxite brick, 56% Al_2O_3, f.o.b. Pittsburgh	1,000	$140-$145
Chrome brick, f.o.b. Eastern shipping points	ton	45-47
Chrome cement, 40-50% Cr_2O_3	ton	23-27
40-45% Cr_2O_3, sacks, f.o.b. Eastern shipping points	ton	23.00
Fireclay brick, 1st. quality, 9-in. shapes, f.o.b. Ky. wks.	1,000	42-45
2nd. quality, 9-in. shapes, f.o.b. wks.	1,000	35-38
Magnesite brick, 9-in. straight (f.o.b. wks.)	ton	65-68
9-in. arches, wedges and keys	ton	80-85
Scraps and splits	ton	85
Silica brick, 9-in. sizes, f.o.b. Chicago district	1,000	48-50
Silica brick, 9-in. sizes, f.o.b. Birmingham district	1,000	48-50
F.o.b. Mt. Union, Pa.	1,000	38-40
Silicon carbide refract. brick, 9-in.	1,000	1,180.00

Ferro-Alloys

Ferrotitanium, 15-18% f.o.b. Niagara Falls, N.Y.	ton	$200.00 –	.....

Ferrochromium, per lb. of Cr, 1-2% C	lb.	$0.30	.....
4-6% C	lb.	.11½	.....
Ferromanganese, 78-82% Mn, Atlantic seabd. duty paid	gr. ton	107.50	.....
Spiegeleisen, 19-21% Mn	gr. ton	38.00	40.00
Ferromolybdenum, 50-60% Mo, per lb. Mo	lb.	2.00	2.25
Ferrosilicon, 10-12%	gr. ton	41.50	46.50
50%	gr. ton	75.00	.....
Ferrotungsten, 70-80%, per lb. of W	lb.	.85	.95
Ferro-uranium, 35-50%, of U, per lb. of U	lb.	4.50	.....
Ferrovanadium, 30-40%, per lb. of V	lb.	3.50	4.00

Ores and Semi-finished Products

Bauxite, dom. crushed, dried, f.o.b. shipping points	ton	$5.50	$8.75
Chrome ore Calif. concentrates, 50% min. Cr_2O_3	ton	22.00	.....
C.i.f. Atlantic seaboard	ton	19.00	22.00
Coke, fdry., f.o.b. ovens	ton	4.50	5.00
Coke, furnace, f.o.b. ovens	ton	3.50	3.60
Fluorspar, gravel, f.o.b. mines, Illinois	ton	23.50	.....
Ilmenite, 52% TiO_2 Va	lb.	.01½	.....
Manganese ore, 50% Mn, c.i.f. Atlantic seaport	unit	.42	.46
Manganese ore, chemica (MnO_2)	ton	75.00	80.00
Molybdenite, 85% MoS_2, per lb. MoS_2, N. Y.	lb.	.80	.....
Monazite, per unit of ThO_2, c.i.f., Atl. seaport	lb.	.06	.08
Pyrites, Span., fines, c.i.f. Atl. seaport	unit	.11½	.12
Pyrites, Span., furnace size, c.i.f. Atl. seaport	unit	.11½	.12
Pyrites, dom. fines, f.o.b. mines, Ga.	unit	.12	.....
Rutile, 95% TiO_2	lb.	.12	.15
Tungsten, scheelite, 60% WO_3 and over	unit	9.25	.....
Tungsten, wolframite, 60% WO_3	unit	9.00	9.25
Uranium ore (carnotite) per lb. of U_3O_8	lb.	3.50	3.75
Uranium oxide, 96% per lb. U_3O_8	lb.	12.25	2.50
Vanadium pentoxide, 99%	lb.	2.00	14.00
Vanadium ore, per lb. V_2O_5	lb.	1.00	1.25
Zircon, 99%	lb.	.06	.07

Non-Ferrous Metals

Copper, electrolytic	lb.	$0.12½	.....
Aluminum, 98 to 99%	lb.	.27	.28
Antimony, wholesale, Chinese and Japanese	lb.	.08½	.09
Nickel, 99%	lb.	.27	.30
Monel metal, shot and blocks	lb.		.32
Tin, 5-ton lots, Straits	lb.	.40½	.40¾
Lead, New York, spot	lb.	.07125	.0725
Lead, E. St. Louis, spot	lb.	.06725	.....
Zinc, spot, New York	lb.	.0610	
Zinc, spot, E. St. Louis	lb.	.0565	
Silver (commercial)	oz.	.66¾	
Cadmium	lb.	.60	
Bismuth (500 lb. lots)	lb.	2.35	2.40
Cobalt	lb.	2.50	3.00
Magnesium, ingots, 99%	lb.	.90	.95
Platinum, refined	oz.	116.00	
Iridium	oz.	275.00	300.00
Palladium	oz.	83.00	
Mercury	75 lb.	76.00	77.00
Tungsten powder	lb.	.95	1.00

Finished Metal Products

	Warehouse Price Cents per Lb.
Copper sheets, hot rolled	19.25
Copper bottoms	29.25
Copper rods	19.75
High brass wire	17.75
High brass rods	15.00
Low brass wire	19.50
Low brass rods	20.50
Brazed bronze tubing	24.34
Seamless copper tubing	22.75
Seamless high brass tubing	21.50

OLD METALS—The following are the dealers purchasing prices in cents per pound

Copper, heavy and crucible	10.50	@	10 75
Copper, heavy and wire	10.00	@	10 12½
Copper, light and bottoms	8.50	@	8.62½
Lead, heavy	5.75	@	6 00
Lead, tea	4.00	@	4 25
Brass, heavy	6.00	@	6.25
Brass, light	4.75	@	4 87½
No. 1 yellow brass turnings	6.50	@	6.75
Zinc scrap	3.50	@	3.75

Structural Material

The following base prices per 100 lb. are for structural shapes 3 in. by ¼ in. and larger, and plates ¼ in. and heavier, from jobbers' warehouses in the cities named:

	New York	Chicago
Structural shapes	$3.49	$3.49
Soft steel bars	3.49	3.49
Soft steel bar shapes	3.59	3.59
Soft steel bands	4.39	4.39
Plates, ¼ to 1 in. thick	3.59	3.59

Industrial

Financial, Construction and Manufacturing News

Construction and Operation

Alabama

MOBILE—The Continental Roofing & Mfg. Co., 1200 South 16th St., Baltimore, Md., manufacturer of composition roofing products, has acquired the local plant of the Great Southern Roofing Corp., and will take possession immediately. Plans are under way for the installation of additional equipment. It is purposed to resume operations in June. Stanley Woodward is vice-president of the purchasing company.

CHEROKEE—The Cherokee Rock Asphalt Co., Cherokee, near Sheffield, is perfecting plans for the erection of a refining plant at its local sandstone rock asphalt deposits, estimated to cost in excess of $250,000, including equipment. Dr. Miller Reese Hutchison, 233 Broadway, New York, is said to be actively interested in the project.

HUNTSVILLE—The Manganese Products Corp., recently organized, is planning for the development of manganese ore properties in this section, with the installation of a plant for commercial production. The company has a tract of about 900 acres of land. The plant will cost more than $75,000, with equipment. Edward Doty, Huntsville, is acting secretary.

California

DIXIE—The Columbia Cement Co., recently organized by Fred A. Ballin, formerly president of the Monolith Portland Cement Co., with local offices, has acquired a tract of about 2,500 acres of land near Dixie, Imperial County, on the line of the San Diego & Arizona R.R., and plans for the construction of a new cement mill. It will consist of a number of units, with power house and other mechanical buildings, and is estimated to cost close to $1,000,000, with machinery. It is purposed to manufacture a pure white cement from the marble deposits in this section. Mr. Ballin will be head of the new company.

LOS ANGELES—The Petroleum Export Corp., Pacific Electric Bldg., has plans under way for the erection of a new storage and distributing plant at Terminal Island, San Pedro harbor district, consisting of a group of 6-story buildings, each 100x300 ft., and miscellaneous mechanical structures, estimated to cost $2,000,000, with equipment. Glen A. Smith is vice-president.

MONROVIA—The North American Products Co., recently organized with a capital of $25,000, has plans under consideration for the establishment of a new local plant for the manufacture of polishes and kindred products. George W. Thomas is secretary and treasurer.

VENTURA—The Southern Counties Gas Co. will make enlargements in its local artificial gas plant, including the installation of additional compressors and other equipment, estimated to cost $50,000.

Florida

TAMPA—The First Psychological Development Association, recently organized with a capital of $1,000,000, has purchased a site on the Temple Terrace Boulevard for the erection of a new plant for the manufacture of hollow tile products, and will begin work at an early date. The initial works will be 50x110 ft., and estimated to cost $75,000, with equipment. Dr. H. L. Clough is president.

PERRY—The Perry Foundry & Machine Co. has work under way on a new foundry in the southeastern section of the city. H. T. Wilkes is head.

Indiana

INDIANAPOLIS—The Pivot City Printing Ink Co. will establish a new plant in the Mars Hill section for the manufacture of a variety of printing inks.

KOKOMO—The D. C. Jenkins Glass Co., manufacturer of pressed and blown table glassware, etc., is arranging for enlargements in its plant for increased capacity. Contract has been awarded for the installation of a new lehr.

Kansas

BONNER SPRINGS—The International Cement Corp., 342 Madison Ave., New York, has work under way on additions and improvements at its local mill, including the installation of additional equipment. It is expected to complete the work during the summer.

Louisiana

SHREVEPORT—In connection with reorganization plans, the Caddo Central Oil & Refining Co. purposes to develop a fund of about $500,000, to be used for the installation of additional cracking and other equipment at its gasoline-refining plants, including enlargements in existing works. New York headquarters of the company are at 61 Broadway.

Maryland

BALTIMORE—The Standard Sanitary Mfg. Co., Bessemer Bldg., Pittsburgh, Pa., manufacturer of enameled iron sanitary ware, is completing plans for another unit at its new works on 5th Ave., Canton, and will break ground at an early date. It will be 1-story, 77x590 ft., and equipped as foundry, estimated to cost $300,000.

Massachusetts

SALEM—The Strauss-Limon Co., recently organized, has taken over a local tannery on Fort Ave., and will operate for the production of split leathers for shoe and glove manufacture. It is purposed to develop maximum capacity at an early date. The new company is headed by B. H. Strauss and M. Limon.

TEWKSBURY — The Wamesit Chemical Co., Lowell, Mass., manufacturer of lactic acids, etc., is said to have authorized plans for the erection of a 1- and 2-story plant, to replace the portion of its local works recently destroyed by fire. The new structure with equipment is estimated to cost approximately $100,000. G. Stevens is president.

BOSTON—The Standard Sanitary Mfg. Co., Bessemer Bldg., Pittsburgh, Pa., manufacturer of enameled iron products, has awarded a general contract to the Pultz Co., Inc., Boston, for the construction of its proposed 6-story factory branch, 80x200 ft., at 365 C St., South Boston, to cost about $150,000. French & Hubbard, 210 South St., Boston, are architects.

Michigan

DETROIT—The Howard Flint Ink Co., 1424 Sherman St., has plans for the erection of a new 2-story and basement plant, 100x230 ft., at Scotten Ave. and the Michigan Central R.R., and plans to begin work at an early date. Weston & Ellington, Stroh Bldg., are architects. H. H. Flint is president.

Minnesota

TWO RIVERS—The Becker Mfg. Co. is planning for the erection of an addition to its foundry for the production of iron castings.

Nebraska

COZAD—The American Beet Sugar Co., Extension Department, 32 Nassau St., New York, has commenced work on a local beet sugar experiment station for testing beet varieties to determine suitability for service. Equipment will be installed at an early date.

New Jersey

FLEMINGTON — The Fulper Pottery Co., manufacturer of art pottery, has acquired property in the vicinity of its plant, heretofore used by the D. & H. Candy Co., and will remodel and equip for a new line of commercial art pottery. An addition will be built 70x80 ft., and two new kilns constructed.

JERSEY CITY—The F. E. Schundler Corp., Joliet, Ill., magnesite, magnesium and kindred products, has leased the former plant of the Morgan Engineering Co., at the foot of Morgan St., consisting of two build-

ings, totaling about 10,000 sq.ft. of floor area, and will occupy for a new branch plant. It is expected to install equipment at an early date.

RIDGEFIELD—The Lowe Paper Co., River St., has awarded a general contract to the H. Wales Lines Co., Meriden, Conn., for the erection of its proposed mill additions, consisting of three 1-story buildings, 40x260 ft., 48x120 ft. and 50x94 ft., to cost approximately $150,000. Considerable additional equipment will be installed. Frederick L. Smith, 21 East 40th St., New York, is architect.

JERSEY CITY—The Richard Chemical Co., 116 Essex St., has filed plans for extensions and improvements in its plant to cost about $25,000. Robert Shannon, 1 Bernius Court, Jersey City, is architect.

New York

BUFFALO—B. F. Stinson, 422 Niagara St., manufacturer of polishes, etc., has filed plans for the erection of a 1-story addition, estimated to cost $15,000, to be used for general increase in capacity.

NEW YORK—The Harlem Sugar Co., 3445 8th Ave., has awarded a general contract to the Delta Construction & Engineering Co., 15 East 40th St., for the erection of its proposed 1-story building on the Southern Blvd., to be 100x125 ft., estimated to cost $35,000. Charles S. Clark, 441 East Tremont Ave., is architect.

Ohio

SEBRING—The French China Co., manufacturer of general ware, has completed plans and will begin the erection of a 1-story addition to its plant, 100x500 ft., estimated to cost $100,000, with equipment. O. H. Sebring is president.

PORTSMOUTH—The Linde Air Products Co., 30 East 42nd St., New York, manufacturer of industrial oxygen, oxy-acetylene apparatus, etc., has preliminary plans under way for the erection of a new local plant, consisting of a number of 1-story buildings. The reported cost is placed in excess of $100,000. It is expected to call for bids at an early date.

CLEVELAND—The Industrial Fiber Co., West 98th St. and Walford Ave., manufacturer of artificial silk products, has preliminary plans under advisement for extensions and improvements in its plant, including remodeling of the existing works. It is purposed to provide facilities and equipment to increase the present output about 15 per cent. Walter Birge is president.

WELLSVILLE—The American Sheet & Tin Plate Co., Frick Bldg., Pittsburgh, Pa., is arranging for the rebuilding of the polishing department at its local works, including the modernizing of machinery and facilities, and the installation of additional equipment for increased production.

Pennsylvania

PHILADELPHIA — The Pennsylvania Salt Mfg. Co., Widener Bldg., manufacturer of industrial chemicals, salts, etc., will begin the erection of a new 1-story plant at Porter St. and Weccacoe Ave., estimated to cost about $40,000. A permit for the structure has been issued.

BETHLEHEM—The Bethlehem Steel Corp. has disposed of a bond issue of $30,000,000, and will use a considerable portion of the proceeds for plant enlargements and betterments, including the Lackawanna Works, Buffalo, N. Y.; Cambria Works, Johnstown, Pa.; and the Midvale Steel & Ordnance plant at Coatesville, Pa. Considerable additional machinery will be installed. The company is also perfecting plans for similar expansion and improvement at its Sparrows Point, Baltimore, Md., mills, including large additions in the rail department.

Tennessee

NASHVILLE—Following the purchase of an existing plant at Jordan St. and the Tennessee Central R.R., the Liberty Brick & Tile Co. is perfecting plans for the installation of tile-making machinery, for considerable increase in output. R. M. Hall is president.

NASHVILLE—E. W. Cooper, 174 3rd Ave., N., engineer, is planning for the purchase of pulverizing machinery for installation at a local plant.

Texas

ROBSTOWN—The Robstown Oil Mill Co., recently chartered with a capital of $100,000, is reported to have plans under way for the erection of a new plant on local site, estimated to cost about $65,000, with equipment. William Bauer, Jr., and G. F. Dryden, Robstown, head the company.

FORT WORTH—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until June 2, for two nitrogen compressors, for local service, as specified in Schedule 2204.

Virginia

RICHMOND—The Fibre Board Container Co., 3200 Williamsburg Ave., is reported to have preliminary plans under advisement for enlargements in its plant, including the installation of considerable additional equipment. D. J. Donati, Jr., is president.

Washington

SEATTLE — The Seaman Paper Co., 208 South La Salle St., Chicago, Ill., is said to have plans in preparation for the construction of a new paper and pulp mill on local site, consisting of a number of buildings, estimated to cost $1,500,000. Application has been made to the municipal power bureau for service for operation totaling about 25,000 hp. capacity.

TACOMA—The Pacific Foundry Co., 1113 St. Paul St., is considering plans for the erection of a new 1-story foundry, on site selected at 1001 D St., estimated to cost $25,000. John Borger is president.

West Virginia

BLUEFIELD—The Limestone Products Co., recently organized, has acquired a local plant and plans for extensive operations. It is purposed to remodel and enlarge the works in the near future, with the installation of considerable additional equipment. C. A. Rothrock is general manager.

WHEELING — The Wheeling Stamping Works, Inc., 2119 Main St., metal products, is considering preliminary plans for the rebuilding of the portion of its plant, recently destroyed by fire. An official estimate of loss has not been announced.

SISTERSVILLE—The John B. Scohy Glass Co. has plans under way for improvements in its local plant, including the installation of machines to replace hand operation. The plant has recently curtailed production and it is said that the change will be made before it is reopened.

Wisconsin

LA CROSSE—The La Crosse Rubber Mills Co., Indian Hill, is considering tentative plans for the erection of a 4-story addition, 50x160 ft.

New Companies

H. & H. CHEMICAL CO., 1543 Clybourn Ave., Chicago, Ill.; chemicals and chemical byproducts; $10,000. Incorporators: Edward C. and Alvin H. Heuer, and Joseph Hill.

DURE PAINT CO., Mobile, Ala.; paints, varnishes, etc.; $15,000. Incorporators: Leon L. Dure and Thomas M. O'Hara, both of Mobile.

EARLY PORCELAIN ENAMEL CO., Brooklyn, N. Y.; enamels for iron, etc.; $20,000. Incorporators: J. N. Early, T. Schwartz and L. Diercke. Representative: C. M. Early, 38 Park Row, New York.

ANIMAL RENDERING CO., Philadelphia, Pa.; greases, soaps, etc.; $15,000. J. W. Lee, 1032 Fillmore St., Philadelphia, is treasurer and representative.

GILROY STEEL CO., INC., 1955 Park Ave., Weehawken, N. J.; steel products; $125,000. Incorporators: Daniel A. Haggerty, J. Harry O'Brien and Louis F. Beachner.

MURESQUE TILES, INC., San Francisco, Calif.; mosaics and fine ceramics; $100,000. Incorporators: William F. Muir, Marvin L. Yerington and Albert B. Johnson. Representative; Clifton H. Connick, Merchants Exchange Bldg., San Francisco.

RENEWER VARNISH CO., Cincinnati, O.; paints, oils, varnishes, etc.; $10,000. Incorporators: Albert C. Wicker and William C. Gill, both of Cincinnati.

NORTHWESTERN MINERAL PRODUCTS CO., 112 South Church St., Rockford, Ill.; to operate mining and refining plants for the production of kaolin, clay and minerals; $50,000. Incorporators: Philip H. Gleason, George R. Picken and Robert Wehenn.

ARCHER DUKE OIL CO., Wichita Falls, Tex.; refined oils; $40,000. Incorporators: W. L. Duke and J. E. McKee, both of Wichita Falls.

BADGER GRAY IRON FOUNDRY CO., Milwaukee, Wis.; gray iron castings; $10,000. A. Butzen, 763 25th St., Milwaukee, is the principal incorporator.

VOLOSHEN CHEMICAL CORP., Pittsburgh, Pa., care of the Capital Trust Co. of Delaware, Dover, Del., representative; chemicals and chemical byproducts; $20,000. Joseph Voloshen, Pittsburgh, principal incorporator.

FEDERAL COPPER CO., San Francisco, Calif.; metal smelting and refining; $2,500,000. Incorporators: Charles H. Victor, W. B. Curtis and A. M. Moffett. Representative: W. H. Spaulding, 14 Sansome St., San Francisco.

NORTHERN PAINT & VARNISH CO., New York; paints, oils and varnishes; nominal capital $5,000. Incorporators: M. Silverman and H. Rayack. Representative: S. Berger, 331 Madison Ave., New York.

PROVIDENT CHEMICAL WORKS, INC., St. Louis, Mo.; chemicals and chemical byproducts; $150,000. Incorporators: S. H. Thomson and C. E. Udell, both of St. Louis.

KAUFMANN DUNTIL CO., Saginaw, Mich.; cement and concrete products; $10,000. Incorporators: Henry, Alvin J. and Harvey E. Kaufmann, 732 Tenth St., Saginaw. The last noted is representative.

Industrial Notes

THE WESTINGHOUSE ELECTRIC & MANUFACTURING CO. announces the opening of a downtown office at 1202 Keenan Bldg., Seventh and Liberty Aves., Pittsburgh.

THE MIXING EQUIPMENT CO., INC., in order to take care of increasing business, has removed its home offices and showrooms from 50 East 42nd St. to more spacious quarters at 229-231 East 38th St., New York. In these larger showrooms the company will be able to show the Lightning Portable Mixers in operation and carry on various tests with mixing fluids of all kinds.

THE PURE OIL CO. has appointed B. S. Sorelle manager of the Texas producing division, with territory embracing all of the Gulf coast states. He will maintain headquarters at Mexia, Tex.

THE YOUNGSTOWN PRESSED STEEL CO., Warren, O., has elected Charles A. Morrow vice-president. Mr. Morrow was formerly sales manager.

SMITH-HEYLANDT CO., 2633 Fourth St., Southeast, Minneapolis, Minn., has recently been organized with a capital of $500,000 to take over the patents, importation, sale and distribution of the Heylandt apparatus for the manufacture of oxygen and other gases by the liquefaction process. In addition to liquefaction apparatus, liquid oxygen breathing equipment will be manufactured. Elmer H. Smith, president of Smith's Inventions, Inc., and the Commercial Gas Co., heads the new organization as president. John R. R. Miles will be secretary and Herman G. Amling, of Maywood, Ill., former representative of the Heylandt Co., will co-operate with the new organization.

THE SOUTHWEST PETROLEUM CORPORATION, Los Angeles, Calif., recently formed to take over local oil interests, has elected W. W. Stabler, president; T. M. Pike and J. P. Delleau, vice-presidents; Benjamin S. Hunter, secretary, and Walter A. Bonynge, treasurer.

COLWELL & MCMULLIN, New England representatives of the Conveyors Corporation of America, Chicago, are located in their new offices in the Park Square Bldg., Boston. Colwell & McMullin handle the sales of American steam jet ash conveyors, American air-tight doors and other power plant specialties in Boston and the New England states.

L. A. MARSHALL, for a great many years service manager of the Industrial Works, Bay City, Mich., is now connected with that company's Chicago office, 1051 McCormick Bldg., as sales engineer.

MAJOR W. C. TROTTER, president of the Standard Clay Products Co., Ltd., St. Johns, Que., and New Glasgow, N. S., has resigned as general manager of that company, but has assumed the office of managing director. Major Trotter continues as president of the company, but will not be connected with its active management for the next few months, as he has been ordered by his physician to go to California for a rest and change of climate. His son, C. S. Trotter, who has been manager of the firm's New Glasgow plant, succeeds him as manager of the company.

THE KUHLMAN ELECTRIC CO., of Bay City, Mich., manufacturer of power, power distribution and street lighting transformers, has opened a sales office at 300 Madison Ave., New York City, in charge of D. F. Potter, Jr., New York manager.